THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

VOL. VI.—1840.

WITH NUMEROUS ILLUSTRATIONS.

LONDON:

G. BERGER, HOLYWELL STREET, STRAND;

AND ALL BOOKSELLERS.

CITY PRESS, 1, LONG LANE:
DOUDNEY AND SCRYMGOUR.

PREFACE.

THE extensive circulation of the PENNY MECHANIC, and the encomiums which are bestowed upon it by high and respectable authorities, assure us that our constant endeavours to render it useful and entertaining have not proved abortive; and our gratitude for the distinguished patronage we have so long enjoyed, will not exhale in vain expressions of thanks to our numerous friends, but will stimulate us to farther exertions, to render it worthy of the great and good cause in which we are engaged—the supply of valuable information to the operative and the productive classes, as well as to all lovers of arts and sciences; and proffered at so low a price, that all who wish for it can obtain it.

The present Volume contains, besides much other interesting matter enumerated in the Index, copious descriptions of numerous patent inventions, which cannot be obtained elsewhere without considerable expense and laborious research. Discoveries which have cost the inventers years of study and anxiety, as well as vast sacrifice of money, both in the prosecution of the necessary experiments, and in satisfying the monstrous extortions of the oppressive patent laws, are here revealed in a few columns, forming less than the fourth part of a Penny Number!

We are much indebted to our numerous correspondents, who have assisted so largely in rendering the PENNY MECHANIC a source of various and valuable knowledge; and we trust that, in the ensuing year, 1841 (which will be comprised in one Volume, forming the first of a new series) we shall be equally favoured, and, considering the increasing circulation of this work, and the great facility of communication now afforded between the most distant places in the country, perhaps even more so than in former Volumes—so far, at least, as the necessarily limited space of so cheap a publication will allow.

The flood of cheap literature with which society is now inundated, must very materially affect the national character: the schoolmaster is, indeed, abroad, for he is everywhere. But while the mighty press is unceasingly

asserting the dominion of truth and reason, and inculcating precepts of virtue, industry, and good citizenship, a debasing principle is exerted in the propagation of vice, folly, and error. This is an unavoidable evil; for the same law which tolerates the publication of "Jack Sheppard," secures the PENNY MECHANIC from the thraldom of a vexatious and arbitrary censure: but evils which cannot be prevented by law, should be checked by the public, on whose patronage depend the success and, ultimately, the existence of every publication. To encourage and promote the circulation of useful and civilizing knowledge, is to lead men to the pursuit of laudable and profitable objects, and thus discourage and check the importunities of vice and the dissemination of pernicious doctrines, by creating a distaste for them. The PENNY MECHANIC can boast of being unsullied by any sentiment or expression which the most fastidious would condemn; and its unparalleled low price, combined with the great variety of information which it contains, peculiarly adapts it to the scientific and artistical wants of the working classes.

In concluding the Sixth Volume of the MECHANIC, we renew the expression of our gratitude for the encouragement we have received, and trust that, during the forthcoming year, we may chiefly owe an increased circulation to the increased prosperity of our beloved country, and the establishment of peace and kindly feeling among all classes of Englishmen.

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 90, NEW SERIES. } SATURDAY, MAY 2, 1840. PRICE ONE PENNY. { No. 211, OLD SERIES.

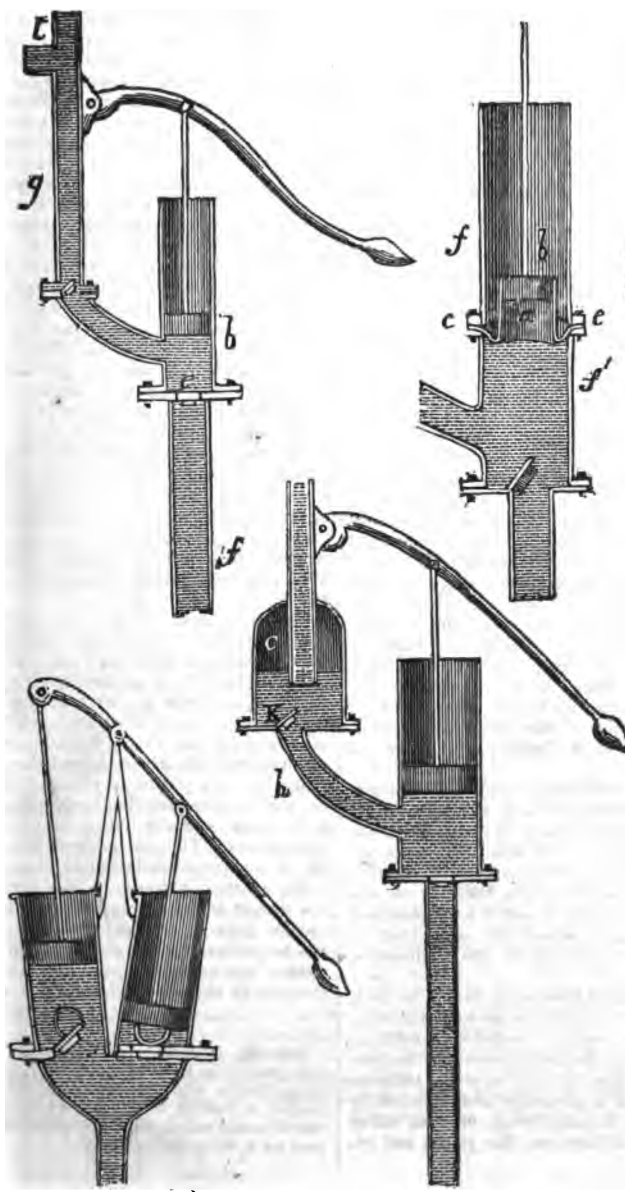
CONSTRUCTION OF PUMPS.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.



City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

HISTORY AND APPLICATION OF THE PUMP.

NO. II.

(See Engraving, front page.)

In my last paper, I endeavoured to explain, that those pumps which depend entirely upon atmospheric pressure for their action, are incapable of drawing water from a greater depth than thirty or thirty-two feet; yet water may be raised by them to any required height above that, by lengthening the pipe above the piston, and placing the cistern and discharging orifice at the top of the pipe. But there is a great inconvenience attending this contrivance, for the piston-rod, if extended to any great length, is extremely liable to bend, and thus materially deteriorate the working of the machine. In those situations, therefore, where it is required to draw water from any great depth, or to raise it to any great elevation, the forcing pump is generally employed, of which there are various modifications. The following is a description of one of the simplest construction of this class of pumps:—*a*, fig. 1, is a truly-bored hollow cylinder, having a solid air-tight piston, *b*, working within it; *f* is the feeding-pipe, with a valve, *c*, at the top, opening upwards; *g* is the ascending pipe, and *t*, the discharging orifice. Now, when a vacuum is formed in the working barrel by the elevation of the piston, the water is forced up the feed-pipe through the valve, *c*, into the barrel or body of the pump, by the external atmospheric pressure; and the moment the piston is lowered, the valve, *c*, closes, which effectually prevents the return of the water to the cistern; it is, therefore, forced up by the piston through the valve, *p*, into the ascending pipe, *g*, from which it is discharged at any required height.

This kind of pump is applicable to many purposes connected with the arts; it is generally considered to be one of the most useful machines of the kind we possess. In addition to its evident utility in raising water to great elevations, there is an extraordinary degree of power to be obtained by it, which is beautifully exemplified in the place it occupies in the hydrostatic press.

The piston of this pump, it will be seen, requires to be made, so as to fit the interior of the working barrel with such accuracy, as to effectually prevent the passage of the least particle of water between them, which is generally accomplished by introducing flannel, hemp, or some other soft material between the piston and cylinder. This contrivance, however, occasions a considerable deal of friction against the interior of the cylinder, which renders it extremely hard to work. This is, in some degree, obviated, by introducing a leather collar between the piston and cylinder, which allows the piston to work its full stroke without the least friction, and renders it perfectly air-tight, as shown in fig. 2; *b*, the piston; *a*, the collar, fastened to the piston, and to the jointed cylinder, *f f*, by means of screws, *c c*.

A pump made on this principle is, however, incapable of maintaining a constant and equable flow of water from the ascending pipe, *l*, in consequence of the almost imperceptible elasticity of the water, preventing its receiving the contents of the cylinder, without putting the whole of the water contained in the pipe in motion, which motion might be continued with less force than originally employed, if the piston kept moving upwards; but the descent of the piston allows sufficient time for that motion to be lost. This is, however, remedied, by having two or more pumps to discharge their contents into one ascending pipe, by means of a working handle so arranged, that each piston shall be alternately elevated and depressed (as shown in fig. 3), in which case it is never in a state of rest; for as soon as it has received the contents of one pump, the other is ready to discharge itself, so that a constant and equable current, or flow of water, is maintained at the discharging orifice.

The most beautiful plan for preserving a constant flow of water from one forcing-pump, is shown in fig. 4; it is effected by the introduction of an air-vessel, *c*. The water being forced up the lateral pipe, *h*, by the depression of the piston, enters the air-vessel by the valve, *k*, and condenses or compresses the air contained therein, so that when the piston is elevated for the purpose of giving another stroke, the valve, *k*, is closed, and all motion in the lateral pipe ceases. The compressed air, in its effort to expand and assume its original bulk, exerts a pressure on the surface of the water, which forces it up the perpendicular pipe, *l*; so that, whether the piston be performing its upward or downward stroke, the water is continually ascending the pipe by the action of the air-vessel.

EPICTETUS.

Gigantic Monkeys.—A communication has been read to the Geographical Society, from Mr. James Brooke, who had passed some time in the interior of Borneo, describing two distinct species of ourang-outang, the larger of which varied from six to seven feet in height!

JUGGINS'S PORCELAIN WEIGHTS AND WEIGHING PLATES.

The inventor of this excellent contrivance, is Mr. William Juggins, 22, James Street, Covent Garden. Besides the advantages set forth in the following paper, which we have received from the manufacturer, these weights will, by the incorruptible nature of the material of which they are composed, afford a satisfactory guarantee of their accuracy to the public, and, at the same time, protect tradesmen from the disagreeable consequences of the scrutiny of the annoyance jury, which cannot always be guarded against, when the ordinary metallic weights are used, owing to their liability to wear and to corrode. The same reasoning will also apply to the weighing plates; for every time the metal plate undergoes the operation of scouring, it loses something of its weight, to the prejudice of the seller. Mr. Juggins thus explains the use of his invention:—

"Notwithstanding the many attempts that have been made to introduce to the trading public, a composition for the manufacture of weights that will resist the action of the atmosphere, and the different articles sold, such as salt, &c., causing much inconvenience, both as regards their being continually out of order, and the filthy state they are always in from the above causes, all have hitherto failed to remedy the evil.

The inventer of the present improvement, in submitting his weights to the notice of the public (which have been highly approved of by the Society of Arts and Sciences, and for which he has received a silver Isis medal), begs to state the following advantages which may be derived from their use:—

In the first place, the atmosphere and other causes before named, have no effect on them; secondly, they are very superior in appearance to the old iron weights; thirdly, in point of cleanliness; and, fourthly, remaining in a perfect state, as from the material they are composed of, they cannot wear like the ordinary weights.

The inventer flatters himself that, from the many advantages that will be gained by their use, it will insure to him the liberal encouragement of the public.

Juggins, of James Street, Covent Garden, invented and introduced to the public notice, a few years since, his butter-plates and stands of a similar composition; the encouragement he has met with, and the sale of which far exceeding his most sanguine expectation.

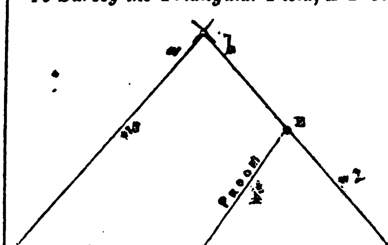
Juggins's improved Weighing Plate and Butter-stand.

The advantage to cheesemongers, butchers, and all dealers in eatable commodities, from this improvement, will be obvious to those who are practically acquainted with the defects of the scale-plate, now in common use:—First, the action of the atmosphere producing no alteration on it; second, in cleanliness, which is an advantage to buyer and seller; third, effecting a great saving of time in scouring and cleaning, as well as of wear and tear in the scale itself; fourth, the appearance being ornamental as well as useful. The scale will also be found worth the attention of chemists, grocers, colour-dealers, and all articles requiring genuineness and purity. And the butter-stand cannot fail to be appreciated by every tradesman, both as to neatness and economy."

We may add, that this invention has received the sanction of the Society of Arts, and was ordered for publication in the second part of the 50th volume of their Transactions.

LAND SURVEYING.

To Survey the Triangular Field, A B O.



One of the most important instruments in land surveying, is the chain, which was invented by the Rev. E. Gunter, a celebrated professor of geometry about 200 years ago. It is divided into 100 equal parts, called links, each one being 7.92 inches; the total length is four poles, or sixty-six feet; at every ten links are pieces of brass, for facilitating the counting of odd links. The off-set staff is ten links long, and is very useful in measuring from the chain line to the bends in the fences, &c. The field-book is ruled into three columns; the middle column is used for noting the progressive distances measured with the chain; and the others for the offsets taken on the right and left-hand sides. It is necessary, also, to sketch the fence in the field-book as you proceed, as it assists you very much in

plotting your work; and you are also enabled to note on which side of the fence the ditch is, whether the adjoining land is arable or pasture, names of owners, &c. It is best to begin taking notes at the bottom of the book, and write upwards.

Having set up marks at A B and O, you commence at A, and measure towards B; and when you arrive at D, a station must be made in the ground, and noted in the field-book (as this will be required for the purpose of proving the survey); from B, you measure towards C, putting down a station at E; from C, measure towards A; from D, measure towards E, and the survey will be completed. The notes in the field-book will stand thus:—

	460	to 500 in 2.
	4*	at 600 in 1.
	908	to end of 1.
	3*	at end of 2.
	908	to o in 3.
9	500	
	2*	at end of 1.
	1200	to o in 2.
∂	600	
	1*	

Thus it will be seen, that at 600 links on the first line, a station is left, and the line is 1200 links long; the second line begins at the end of the first (leaving a station at 500 links), and goes to 0 in the third; the third line begins at the end of the second, and goes to 0 in the first; the fourth line (the proof) begins at 600 in 1, and goes to 500 in 2. The next thing is, to plot the work upon paper, which is done in the following manner:—Draw the line A B = 1200 links, marking the station at 600; take a pair of compasses, and, with B as a centre and radius = 908 links, describe the arc, *a a*, with A as a centre, and the same radius describe the arc, *b b*; draw lines to the point of intersection, and the field will be plotted. Lay your scale from D to E, and if it be 460 links, the work is right. To find the area of the field, multiply the length of the base by half the perpendicular, and it will give it in square links; then reduce it to acres, roods, and perches, by multiplying by 4 and by 40, cutting off five figures to the right hand for decimals, thus:—

$1200 \times 341 = 409{,}200 \therefore 409{,}200 \times 4 \,\&\, 40 =$

A.	R.	P.
4	0	15

G. R.

LIFE ASSURANCE.

NO. IV.

PROFITS.

THE rates of premium of three offices in London, which were pointed out in our last chapter, are those charged annually to assure any person at death, 100*l.*, together with all the profits (that is, a proportionate share, according to the interest each person had in such society); and such profits are ascertained, made known, and divided among all the members assured, every year.

This mode is the more equitable on several accounts; first, because, as has been shown, every Society will in some years find fewer persons die than was set forth in their tables of *expectancy*, and upon which their rates of premium were calculated; and, consequently, some money will have been received by such Society, beyond the actual risk which it has incurred on behalf of such persons. But this fact can only be ascertained by trial and experience.

Secondly, an annual division of whatever profits a Society may realize, is more just than either quinnial, septennial, or deceminal divisions; inasmuch as numbers may die before the period of division arrives, when such period occurs but once in five, seven, or ten years; and thus another person, most probably a stranger, becomes possessed, not by right, but by a mere change of circumstance, of that portion which should have been assigned to the property of the person who died before such division took place. And a moment's reflection will show, that although a greater share of profits will accrue to those who survive the long period of division, yet, by an annual distribution only, can the profits be fairly divided, however small they may be in consequence of such a method.

Thirdly, the reason for dividing all the profits among the several members is obvious, when we consider, that whatever premium a person pays into an Assurance Society for a promised sum of money, it is deemed and understood at the time to be a sufficient sum for purchasing such a benefit; and that, necessarily, whatever gain a Society may make by putting out such premiums to a better interest than had been estimated; or, by any other method, all such gains, after paying for the expenses of management, belong, strictly speaking, to the members alone; and, in those Societies we have mentioned, and in several others, these are privileges which

they allow, and which places them so much above Societies based upon the joint-stock principle, a subject which we shall speak of in its proper place.

It may be, perhaps, necessary to state what is particularly meant by the word *profit*, which we have so frequently used, and for that purpose we say that, after certain sums of money have been contributed to a Society in the shape of premiums for a promised benefit at a future period, the Society is supposed to have taken the exact amount of money which, if put to interest at three per cent. generally), will meet all the risk it expects to incur on behalf of those persons for that year; so that all who do not die as expected, have paid the Society for a risk which it has not actually run, which has been before observed. And, again, as various means are open by which a greater interest can be made by a Society of its funds, than the three per cent. which had been calculated upon, the results of these circumstances are, to such an extent, the successful gains of the Society for that year. Now suppose, for example, that 20,000*l.* has been paid to any Society for the premiums of one year from the several assurers (which are paid in advance), and that this sum has been improved at interest to the amount of 21,090*l.*; suppose further, that 8,000*l.* has been realized from the investments of the former contributed premiums, called the funds of the Society, beyond what had been calculated upon in the tables; this would then amount to 29,000*l.* Now, in case that no fewer number of assurers die, or make a claim in that year, than was expected to do so, here will be a large surplus of profits, in proportion to the premiums paid for that year, which ought to be divided among the assurers in calculated proportions; and suppose, as may probably be the case, that only 15,000*l.* out of the 29,000*l.* accruing to the Society in that year, will be necessary to be added to all the former premiums paid, to meet every present liability* which the Society is under; then the overplus (14,000*l.*) will constitute the Society's profits for that year; say, deduct a small portion to defray the yearly expenses, and the remainder to be divided among all the assurers in calculated proportions. The greater part of these profits will not, perhaps, be drawn out of the Society, but suffered to remain to accumulate for the succeeding year, and the division of profits may be quite as favourable then, as on the last occasion.

Should the reader consider that there may be greater claims upon a Society than had been expected in one year, and wish to know how these claims will be met, we reply, that this certainly may be the case, but that a Society, if based upon just principles, will have made a provision for this contingency, by calculating in a former year its then present liabilities, and declaring its profits, or real surplus funds, accordingly; so that the gains for such a year of greater risk, if not augmented to the several assured beyond the past year, would not be lessened to any of them one iota.

SIGMA.

* By present liabilities, must be understood the immediate demands which every member would be entitled to make upon the funds of the Society, were he to offer to withdraw his share, and cancel the promises contained in his policy. —*Hardy*.

ANTISEPTIC PROPERTIES OF PEAT.

PEAT possesses the remarkable quality of preserving animal substances for any length of time. In June, 1747, the body of a female was discovered in a peat moor in the Isle of Axholm, in Lincolnshire. Her feet were furnished with antique sandals, and it has been supposed that she was an ancient Briton. Her nails, hair, and skin, are described as having shown scarcely any symptoms of decay. In Ireland a human body was dug up, which was completely clothed with garments made of hair. The clothing of the inhabitants was manufactured from this material before the introduction of wool; but many ages have transpired since this took place, so that the body must have lain an immense time; yet it was perfectly fresh and unimpaired. At the battle of Solway, in the time of Henry the Eighth, when the Scotch army, commanded by Oliver Sinclair, was routed, an unfortunate troop of horse, driven by their fears, plunged into this morass (the Solway moss), which instantly closed upon them. The tale was traditional, but it is now authenticated—a man and horse, in complete armour, having been found by peat-diggers in the place where it was supposed the affair had happened. The skeleton of each was well preserved, and the different parts of the armour easily distinguished. Besides the human body, there have been found in peat bogs, bones of the stag, ox, horse, hog, sheep, and other animals that feed on herbs; and in Ireland, and the Isle of Man, skeletons of a gigantic elk. With regard to the question, whence peat

derived its antiseptic property, it has been conjectured by some, that the carbonic and gallic acids which issue from decayed wood, and also charred wood, which occurs in the lower parts of many peat mosses, may account for it. Vegetable gums and resins will also have this effect. The power of tannin to prevent decay is well known; and its presence in almost all trees, but particularly in the oak, is also well known. Peat beds occupy the sites of forests, especially those of oak and pine; so that tannin, in these, at least, must have been present in great quantities. It may have entered into various combinations, but that it really is to be found in such peat bogs, and to a considerable extent, either in a simple or compound state, appears to be beyond a doubt.

P. Amer.

CURIOUS ANCIENT RECEIPTS.

One may colour ivory, or any other bones, with an excellent green colour, as followeth:—Take strong water, called aqua-fortis, wherein dissolve as much copper as the said water is able; then let the bones you would have coloured, lie in the same all night, and they will be a smaragdine colour.—*Mizaldus.*

All things that come out of the earth, will swim upon quicksilver, though they be heavy, except gold; and gold, though never so little, will sink into it, and be swallowed thereof, and its colour will be turned into silver, which cannot be reduced into the form of gold again, but with fire, nor can be gotten out; and the quicksilver, through the fire, will be dissolved into a smoke, with a perilous smell. —*Mizaldus.*

That writings shall not burn in the fire, take very strong vinegar and the whites of eggs, and put them together; and put thereto quicksilver, mixing and stirring the quicksilver well therein, and with the same mixture anoint paper three times, and, after that, write what you list upon the same paper, and then cast the same writing into the fire; it will not burn.

An egg laid in strong vinegar three days, or a little longer, it makes the shell thereof so tender and soft, that one may draw it through a ring. Cast the same into warm water, and let it lie therein, and it will be hard again.—*Mizaldus.*

Water wherein the leaves and seeds of hemp are sodden, being cast or sprinkled on the earth, will make the worms to come out of the ground, if any be there.—*Mizaldus.*

If some drops of aqua-vitæ be mixed with writing ink, the same will never freeze.—Proved.

Hempseed given to hens in winter, will make them lay eggs apace.—*Gardanus.*

Burning water, called aqua-vitæ, is of a marvellous force in preserving of things, and keeping them from putrifying. For flesh or meats whatsoever moistened therewith, will be safe from corruption and worms.

To separate gold from silver, do thus: —Anoint the silver that is gilded, with oil of linseed, and sprinkle thereon the powder of roach alum and salt armoniack, mixed together; which, being well heated in the fire, and quenched in water, the separated gold will remain therein.—*Mizaldus* had this of a cunning goldsmith.

If one that hath eaten garlick or cummin seed, breathe on the face of a woman that is painted, the colour will vanish away straight; if not, then her colour remains as it did before.—*Lang.*

Grind mustard with vinegar, and rub it well and hard on the palms of the hands or soles of the feet, and it will help and quicken forgetful persons.—*Petrus Hispanus.*

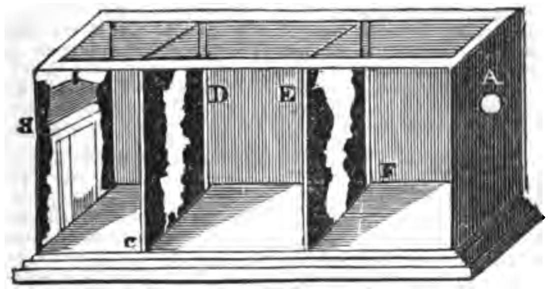
If a large round vessel, with one hole on the top thereof, be filled with quicklime and brimstone, of both equal portions, and the hole well stopped, that no air nor anything may go out, and so put in some standing water, or a little pit of water, or into some cistern full of water, it will keep the said water hot a long time, or for many days.—Proved of many, saith *Mizaldus.*

If you would have copper to melt quickly, and run easily, put the hoofs of a horse into the same, between the melting and pouring out thereof.—*Mizaldus* had this secret of an expert Italian.

THE ARTIFICIAL LANDSCAPE.

Procure a box of about a foot long, eight inches wide, and six inches high; at each of its opposite ends, on the inside of this box, place a piece of looking-glass that shall exactly fit; but at the end, where the sight-hole, A, is, scrape the silver off the glass, through which the eye can view the objects. Cover the box with gauze, over which place a piece of transparent glass, which is to be well fastened in. Let there be two grooves at each end of the places, C D E F, to receive two printed scenes, as follows:—On two pieces of pasteboard, let there be skilfully painted on both sides, any object you think proper' as woods, bowers, gardens, houses, &c.;

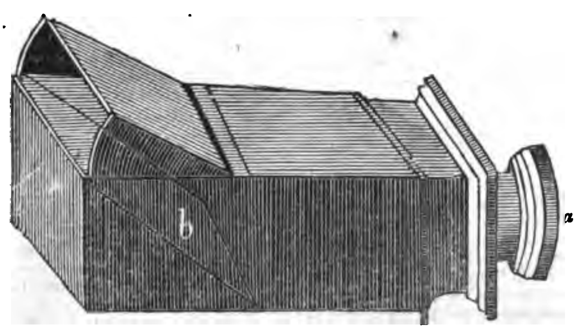
and on two other boards the same objects on one side only, and cut out all the white parts; observe also, that there ought to be in one of them some object relative to the subject placed at A, that the mirror placed at B, may not reflect the hole on the opposite side. The boards, painted on both sides, are to slide in grooves, C D E F; and



those painted on one side, are to be placed against the opposite mirrors, A and B; then cover the box with its transparent top. The box should be placed in a strong light, to have a good effect. When it is viewed through the sight-hole, it will present an unlimited prospect of rural scenery, gradually losing itself in obscurity, and be found well worth the pains bestowed on its construction.

E. LEDGER.

PORTABLE CAMERA OBSCURA.



THE camera obscura is a most amusing optical toy. The above is a box constructed for this purpose. A magnifying glass is placed in the wooden tube, *a*, and the object is thrown upon the angular mirror, *b*. A complete picture of the most extensive view may thus be obtained in the space of a few inches, and the box may be carried in the pocket of the observer.

E. LEDGER.

Luminous Insects.—There are eighteen species of lampyris or glow-worm, some of which are found in almost every part of the world. In many of these species, the females have no wings, and are supposed to be discovered by the winged males by their shining in the night. They become more lucid when they put themselves in motion, which would seem to indicate that their light is owing to their respiration, in which process it is probable phosphoric acid is produced by the combination of vital air with some part of the blood, and that light is given out through their transparent bodies by this flow of internal luminous fluid. There is a fire-fly of the beetle kind, known by the name of acadia, which is said to be two inches long, and inhabits the West Indies and South America. The natives use them instead of candles, by putting a sufficient number under a glass. And it is said that Madam Merian did paint and finish one of them in her work on insects, at Surinam, by its own light. The largest and oldest of them are said to become

four inches long, and to shine like a shooting star as they fly, and are, on this account, called lantern bearers. W. C. D.

The Artificial Volcano.—Take nitre and cream of tartar, of each one ounce; reduce them to a fine powder; add to them a little powdered charcoal, and raise the whole into a heap in the form of a pyramid. Set fire to the vertex, and the clouds of smoke, the flashes of light, the hissing noise, and the torrents of red-hot lava which roll down the sides, entitle it to the appellation of the artificial volcano. The residuum is vegetable alkali, which may be kept in bottles for use.

E. Ledger.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, May 6, Dr. Epps, on Phrenology. Friday, May 8, C. Johnson, Esq., on City Gardening. At half-past eight precisely.

Poplar Institution, East India Road.—Tuesday, May 5, Rev. F. Bishop, on Pneumatics. At eight o'clock precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, May 7, A. Morton, Esq., on the Mechanical Powers (in conclusion). At half-past eight.

QUERIES.

Of what vegetable, and by what process lactucarium is made? Also, how to rectify spirits of wine? Lastly, how to analyze all the different sorts of ink, such as blue, black, red, printing, &c.? X. Y. Z.

This is an age of inventions. What great benefit could be done to that class of people who have an impediment in their speech, if some sort of instrument could give plainness to the words being uttered! Marbles I tried, but it was no good. Perhaps in giving this a place in your Journal, some surgeon, chemist, or others, might undertake it? A Sufferer.

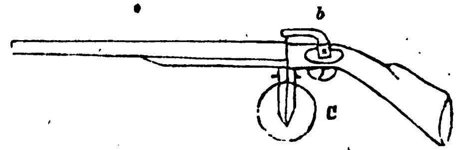
The manner in which the matches for lucifers and congreves are cut; and if by a machine, a description of such? Also, how to extract the stoppers out of smelling and other bottles; having tried the usual methods, but have failed?

S. G. H.

Having to construct receivers for the making of spirit of salt, and a chamber for the making of chloride of lime, to be done with brickwork, please to inform me what cement is the most durable, and the way of preparing it? Also what is the composition of cow-dung? What are the effects of it on the different mordants of calico-printers? Scio.

1. How to stain and varnish violins of a dark colour? 2. How to refine rosin, such as is used for violins? 3. How to make gold and silver bronze powders? E. Ledger.

ANSWER TO QUERY.



I beg to inform "Wm. V—e," that the air-gun is much the same as a common musket, with the addition of a round ball, c, which contains the condensed air, into which it is forced by means of a syringe, and screwed to the barrel of the gun. There is fixed to the ball a valve opening inwards; and when the leaden bullet is rammed down, the trigger is pulled back, which forces down the hook, *b*, upon the pin connected with the valve, and liberates a portion of the condensed air, which, rushing through a hole into the barrel, will impel the bullet to a great distance. E. Ledger.

TO CORRESPONDENTS.

X. Y. Z. *may clean a vessel which has contained balsam, or fluid resin, by washing it with alcohol, or oil of turpentine. How to use a retort, can be explained by any person who has occasion for one.*

M. T. N.—*The hydraulic machine he describes, will not produce the effect he anticipates. No force can be exerted in any direction without a corresponding and equivalent reaction in an opposite direction.*

S. Sandy.—*If he will be pleased to call or send to our office, he will receive the information he requires.*

A Subscriber *has partly anticipated our intentions: but we do not think it would be expedient to reject all matter not immediately relating to science.*

Novicius. *The intense light employed for the oxyhydrogen microscope, &c., is produced by a combined current of oxygen and hydrogen projected against a piece of lime. The two gases are contained in separate vessels, and their relative quantities regulated by cocks; the brightness of the light indicating the proper proportions.*

Erratum.—Page 293, last column, question 3, for "sides" read *bodies*.

London: Printed at "The City Press," 1, Long Lane, Aldersgate, by D. A. Doudney (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. Berger, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

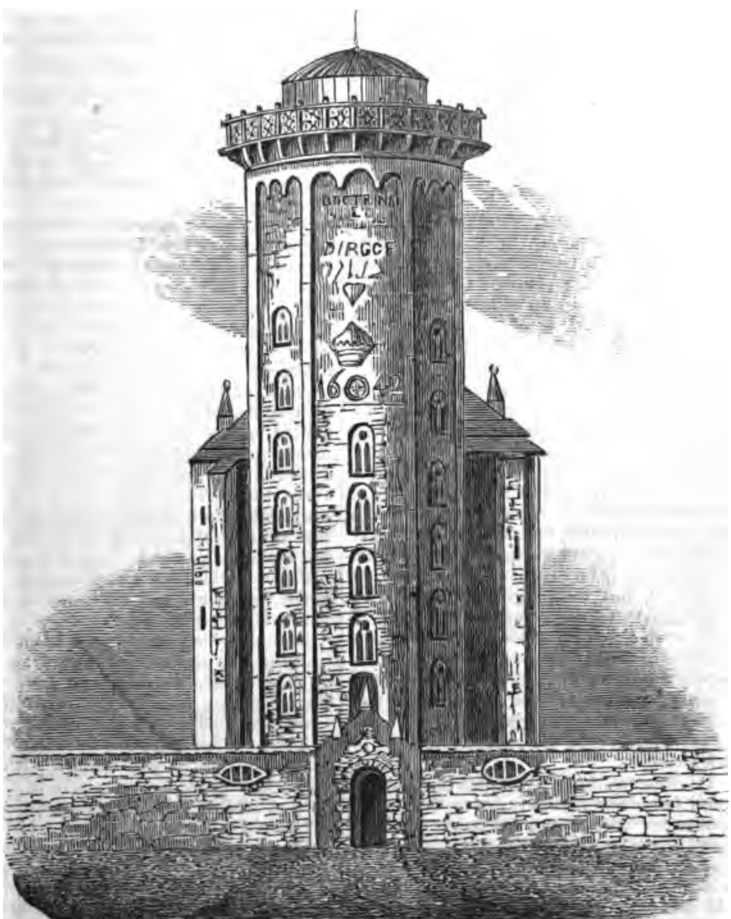
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 91, NEW SERIES. | SATURDAY, MAY 9, 1840. PRICE ONE PENNY. | No. 212, OLD SERIES.

THE ROYAL OBSERVATORY, COPENHAGEN.



 City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

THE ROYAL OBSERVATORY, COPENHAGEN.

(See Engraving, front page.)

THIS observatory is at the top of a round tower, 120 feet high, and seventy feet in diameter. It is ascended by means of a spiral plane, which ascends so gradually, that a carriage may be driven to the top of the tower. Christian the Fourth ascended in this manner. The observatory was erected in 1637, from a plan given by Longomontanus.

The inscription is a semi-hieroglyphic, explained thus:—" Doctrinâ et justitiâ dirige, Jehova, cordem coronati Christiani Quarti, 1642."

ON THE METALS.

(From Hope's " Practical Chemist.")

(Continued from page 291.)

GOLD.—200.

THIS metal has been familiarly known from the earliest ages. It has been uniformly regarded, by all civilized nations, as one of the most valuable substances in nature, and generally used as a circulating medium. It is distinguished from all other metals by its bright-yellow colour. Its specific gravity is 19.3, and its malleability and ductility exceed that of every other metal. It melts at a bright-red heat, but at a higher temperature than that required for melting silver.

Obs. Common gold leaf is exceedingly thin; but the gold that is used in gilding silver wire, such as is employed in making gold epaulettes, is still thinner. " Sixteen ounces of gold, in the form of a cube, would measure one inch and a quarter on each side, but would gild a silver wire long enough to reach around the globe." It is stated by Dr. Black, that fourteen millions of thicknesses of common writing-paper, would be three-fourths of a mile in thickness; whereas, the same number of thicknesses of gold, like that of some gilded wire, would not exceed one inch in thickness.

It is not tarnished by exposure, however long, to air and moisture, even when accompanied with heat; for it has been exposed three months in the melted state, in an open crucible, in a glass-house furnace, without undergoing any change. No single acid acts on gold, but a mixture of nitric and muriatic acid dissolves it readily. This mixture is called aqua regia. When the gold leaf is thrown into warm chlorine gas, it takes fire from the rapid union of the two elements, and a chloride of gold is formed.

Obs. The chloride is also supposed to be formed when aqua regia is the solvent of the metal. In this case, the presence of the nitric acid (in some way not well understood) causes the chlorine in the muriatic acid to unite with the gold, forming the chloride, which is soluble in water.

Immense quantities of this metal are employed in the arts, in the manufacture of various useful and ornamental articles, in which it is generally alloyed with silver or copper, or with both.

Obs. 1. Alloys of gold with silver form the pale-yellow gold, while those of gold and copper have a reddish tinge, and soil light-coloured clothing much less than the yellow alloy.

2. The fineness of gold is expressed in *carats*. The term carat signifies some part of 24. Thus, an alloy composed of 12 parts of gold and 12 of copper or silver, is said to be 12 carats fine; 18 of gold and 6 of copper, forms an alloy that is 18 carats fine; 22 parts of gold and 2 of alloy, form a compound that is 22 carats fine.

Gold is extensively employed in the processes of gilding, of which there are many. Those in most general use are two; that by amalgamation, generally called water-gilding, and that by means of gold leaf, chiefly used for gilding on wood.

Illust. 1. Water-gilding is performed by putting leaves of pure gold in quicksilver, heated nearly to the boiling point; this forms the amalgam. The article to be gilded is made perfectly clean, is then covered with the amalgam, and the mercury evaporated by means of a charcoal fire. A thin coating of gold will be found covering the metal, which is afterwards burnished. It is thus that buttons, watch-cases, jewellery, and all kinds of gilt ornaments, are prepared.

2. Gilding on wood is performed by first priming the article with several coatings of linseed oil, whiting, and glue water; then covering it with gold sizing, upon which the gold leaf being placed, readily adheres. This kind of work cannot be burnished, but may be cleaned with a soft brush and water. The above is the method of gilding signs, picture frames, &c.

Chlorides.—Two or three chlorides of gold have been described by chemists; only one of which has much interest in a practical point of view—namely, that which is formed when the metal is dissolved in nitro-muriatic acid. If this solution be agitated with sulphuric ether, the whole of the gold will be taken up by the ether,

forming what is called the ethereal solution of gold, which is sometimes used for gilding on steel.

Exp. Having prepared the solution according to the above directions, a lancet blade, or any other polished steel, on being immersed in it, is withdrawn with a coating of metallic gold, which adheres very firmly to the metal, forming a handsome gilding.

PLATINUM.—99.

This metal was mentioned by Don Ulloa, a Spaniard, in the account of his voyage to Peru in 1735, but it was brought to Europe by Wood, an assay-master at Jamaica, in 1741, and by him first examined. It derives its name from the Spanish, which signifies little silver, from the idea that it had some relation to that metal.

It occurs chiefly in the metallic state, and is combined with various other metals, especially with gold, silver, iridium, and osmium.

Pure platinum has a white colour, like that of silver, or intermediate between silver and steel; but its lustre is inferior to either. It is the heaviest substance in nature, having the specific gravity, after being hammered, of 21.25 and 21.50, when drawn into wire. It is a soft metal, both malleable and ductile, and, like iron, may be welded at a high temperature. It suffers no change from the action of air and moisture, and can neither be fused nor oxidized in a furnace. Like gold, it is not acted upon by any single acid, but is slowly dissolved in nitro-muriatic acid.

From the above properties of platinum, it is susceptible of many uses in the arts. It is much used in the laboratory, for crucibles and other vessels, on account of the little action of heat and other agents upon it. It is now frequently used by the sulphuric-acid manufacturers for boiling down the acid. Mr. Parkes, of London, had one which cost 300 guineas, used in the preparation of sulphuric acid.

There is an article prepared by chemists, called spongy platinum, which is used for obtaining instantaneous light. The instrument used for this purpose, consists of a reservoir and apparatus for generating hydrogen gas, and a small piece of spongy platinum placed before the jet, on opening which the hydrogen is forced out, and, coming in contact with the mass of spongy platinum, heats it to redness, and this, in turn, sets fire to the gas, from which a taper may be lighted. The spongy platinum is prepared by dissolving the metal in nitro-muriatic acid, and adding a saturated solution of muriate of ammonia, which will throw down an orange-coloured precipitate; this is to be heated to redness, by which means everything will be volatilized but the metal, which will be left in a spongy mass.

METALS NOT USED IN THE ARTS.

Names of Metals.	Discoverers.	Dates of Dis.
Cadmium,	Stromeyer,	1818
Molybdenum,	Hielm,	1782
Vanadium,	Selstrum,	1830
Tungsten,	D'Elhuyart,	1781
Uranium,	Klaproth,	1789
Columbium,	Hatchett,	1802
Cerium,	Hissinger & Berzelius,	1804
Tellurium,	Muller,	1782
Titanium,	Gregor,	1791
Palladium,	Dr. Wollaston,	1803
Rhodium,	———	1803
Iridium,	Descotils & Tennant,	1803
Osmium,	Tennant,	1803

HAIL STORMS.

Hail is unquestionably formed by the congelation of vapour in the higher regions of the atmosphere; and this arises from the warmer air in which the vapour was suspended, mixing suddenly with an intensely cold current of air. Hail is generally defined to be frozen rain; but it differs from ice in this, that the hailstones are not formed of single pieces of ice, but of smal lparticles agglutinated together; some of which are very hard, like perfect ice, while others are soft as snow, or resemble snow that has been hardened by frost. When hailstones are broken open or cut across, they are sometimes within found to be of a very spongy structure; sometimes the interior presents a very beautiful radiated appearance, and not unfrequently exhibits regular and very remarkable concentric plates. Generally, the centre of the hailstone is harder than its surface, and occasionally presents us with a nucleus or sort of core, imbedded in which, bits of straw, wood, and earth have been found; substances which, it may be presumed, were elevated from the surface of the earth by the action of a whirlwind, or some other action. Hailstones vary much in shape; they are generally oval or round, but sometimes thin, flat, irregularly globular, angular, pyramidal, occasionally irregular, having a central point, whence proceed numerous icy spiculæ, like rays, in all directions; and, also, although more rarely, they have appeared as six-sided prisms.

Hailstones vary considerably in size. Some have fallen in Scotland which have been found to weigh five ounces; in North America they have been picked up weighing fifteen ounces; and in 1831, one fell at Constantinople which weighed more than a pound. Volney, in his "Views of the Climate, &c., of America," states, that in July, 1788, while at Ponchartrain, near Versailles, a hail storm suddenly came on, the stones falling at an angle of 45°, some of which he picked up, and weighed more than five ounces.

The reason assigned for the frequency of hail storms in temperate climates is, that the air in these regions is often in a high state of electricity; for which reason the hail showers are so frequently accompanied by thunder and lightning. The distress occasioned by severe hail storms in France was so great, that the attention of scientific men was directed to the phenomena of these storms, for the purpose of their suggesting or devising some means to avert, if possible, the calamities they so frequently occasioned. Accordingly, proceeding on the supposition that these hail storms were occasioned by the unequal distribution and accumulation of electric fluid in the atmosphere, they proposed drawing off the fluid by means of rods, similar to those by which public buildings are protected from the effects of lightning. Numerous experiments were instituted to ascertain the efficacy of these hail-rods in protecting the district from the injuries produced by these storms. In the Annals of the Linnæan Society of Paris, it is stated, that, in many districts on the Continent, this instrument has been adopted with complete success, while, in the neighbouring districts not protected by hail-rods, the crops have been damaged as usual.

A curious and ingenious method of averting the recurrence of these formidable storms, was introduced by the Marquis of Cheviers, a naval officer, living on his estate at Vaurenard, who, having recollected to have seen the explosion of guns resorted to at sea for the purpose of dispersing stormy clouds, resolved to attempt a similar method to dissipate hail storms; for this purpose he made use of boxes of gunpowder, which he caused to be fired from the heights on the approach of a storm. This had the desired effect; and by this means he continued to preserve his lands from their ravages, while the neighbouring villages were frequently desolated. The inhabitants in the commune of Fluery use a mortar, which carries a pound of gunpowder at a charge; and it is generally upon the heights, and before the clouds have had time to accumulate, that they make the explosions.

P. A.

THE PENNY-POSTAGE ACT.

In every quarter, and from every mouth, we hear of the beneficial operation of the Penny-postage Act. The minor branches of commerce have, by its introduction, received a wonderful impetus; and though the invigorating influence of such a cheap means of communication is visible in every department of the mercantile world, it is in the lesser channels, those which immediately connect the vender and the consumer, where its operation and results are most conspicuous. The merchant, whose business may consist solely in exporting and importing, must derive no inconsiderable advantage in the great reduction of charge on his packets of letters and invoices, which, it may not be generally known, are for safety always forwarded in duplicate. To the manufacturer and his agents, with whom may be classed all warehousemen, the item of postage has hitherto been one of some magnitude, and to those, the adoption of the penny rate will have occasioned a diminution of expenditure by no means insignificant; but it is between the warehouseman and the public, through the medium of the retail dealer, that the utility of this popular measure in promoting trade generally, may be seen in its most tangible form. The tradesmen of the distant northern and western counties, doubtless esteem it a boon worth having; for they can now obtain the minutest information that the fickle and many-minded public, their customers, may require, in regard to any particular article they have a wish to order, but which they are unwilling to risk the cost of, without being first satisfied about some point of detail essential to their purpose and object. This is the spirit and practice of retail trade, and it is now accommodated in the most ample manner. The enjoyment and gratification of the public, and the trade of the retailer, are most materially enhanced by this new facility of communication. In the literary world, also, its advantages are incalculable. Philosophy and the arts and sciences may be said to have become thereby popularized. Professors may revel in the unfettered promulgation of new discoveries and advances made in their respective fields of study; and the youthful inquirer may be assisted on every hand, and at every juncture, by this *facile* means of

communication. With such universal aid and co-operation in the diffusion of science, as may be fairly calculated to result from the reduced expense of epistolary intercourse, we may hope now to attain heights that have not been anticipated, and have discoveries and important facts made generally known and rendered available for pleasure and profit to the "herd," instead of being limited, as hitherto, to the cognizance of those only whose pursuits and whose means brought them within the pale of the learned and scientific.

To the poor man, the Penny-postage Act is an invaluable acquisition; it continues him in the companionships of his earlier years, and places him again and again in the cheerful circle of his beloved brothers and sisters; while it is still more valuable to him as a soothing balm to his anxieties for the welfare of his absent children. On the least important matters, advice and counsel may be sought and obtained, while, in weightier concerns, the timely and salutary influence of parental admonition, may be the means of avoiding irretrievable and fatal errors. The spread of useful knowledge by means of cheap periodicals and other publications, combined with the very reduced cost of conveying written communications, is fast changing the labouring toil-worn individual from the isolated being that he was, to a social, intellectual, and more generally-useful man, and will ultimately bring him to be a participator in the rational pleasures and enjoyments incident to cultivated and well-governed minds. This measure stands pre-eminent in point of utility and advantage to the public. No Act of Parliament has been passed for centuries, that has been so generally acceptable, and conferred such direct and immediate benefit on the mass of the people, as the new Postage Act; indeed it differs in this particular from all other public benefits and reforms that have proceeded from the legislature, and it has been signally popular and successful.

OPERATION OF THE PATENT LAWS.

To the Editor of the Mechanic and Chemist.

SIR,—I have now to complain of an injustice, perhaps inflicted through the instrumentality of an unjust patent law, which secures to the rich man that which he may pilfer from the poor inventer—the fruit of years of anxious study, when retired from his daily toil; thus is his only hope of bettering his condition in this life suddenly cut off.

The ground of complaint is, that a Mr. Samuel Hall has just taken out a patent for a "Reefing Paddle-wheel," upon the principle of my invention, as noticed in No. 73, Vol. II., of the "Penny Mechanic," the idea of which occurred to me about twenty-six years ago at Liverpool, when a Mr. Gladstone was experimenting on the effect of paddle-wheels in propelling a boat on the river Mersey, worked by manual power, before the appearance of marine steamers on that river.

Since that period, I have watched the progress of all attempts at improvement in that department of marine machinery. I have been in rough and heavy seas in large-class steamers plying between Liverpool, Cork, and Bristol, and have particularly noticed the defect of the common paddle-wheel. I embraced the first opportunity which presented itself, of constructing a model on the principle of my invention about five years ago.

In May, 1837, I obtained an interview with Dr. Beaumont and other gentlemen, who considered my invention a perfect remedy against all the evils complained of in the use of paddle-wheels, and far superior to anything of the kind ever produced before. It was, however, agreed upon, to take the opinion of some eminent practical engineer; Mr. Field, of the Firm of Moudsley and Field, was selected. I attended with one of the gentlemen above alluded to, when Mr. Field, after minutely examining the model, pronounced sentence: it was condemned. Mr. Field said it would not last a voyage to Gibralter; that no paddle-wheel, having shifting paddles, would answer in sea-water, and that a trial would cost 500*l.*! About this time the engines were being put in the *Great Western* steam-ship. I was informed that a new plan had been adopted to expand and contract the paddle-boards, by means of "set screws." I considered this an infringement or imitation of my invention.

The whole machinery having undergone a public inspection, would afford Mr. Hall, or any other gentleman, an excellent idea to construct a "reefing paddle-wheel." In consequence of the objection made to my first invention, I set about constructing another wheel, which will lessen the amount of friction complained of. In conclusion, I would ask, can Mr. Hall prevent me from taking out a patent, or manufacturing paddle-wheels on the principle of my invention? If not, I wish to add, that I am ready to receive any pro-

posals from any gentlemen who may wish to take the matter in hand.

I remain your obedient servant,

THOMAS MATHEWS.

14, Portland St., Wardour St., Soho,
April 20th, 1840.

[We are sorry to say, that the only *chance* our correspondent has of obtaining redress is, to plunge himself into that devouring abyss—the law. The patent laws of this country are as stupid as they are wicked and oppressive, and they must be entirely remodelled. We intend to take up this subject in such a manner that, if we meet with the support we anticipate, the desirable object will soon be attained. —ED.]

THE CHEMIST.

ON ALKALIES.

(Continued from page 292.)

CONIA (Vegeto).—This alkali is the active principle of hemlock. It is volatile, and uncrystallizable; but has not been farther examined by English chemists.

Corydalia (Vegeto), was discovered by Wackenroder, in the fumitory. When in the plant, it is in combination with malic acid; it is set free by magnesia; malate of magnesia is formed, and the corydalia is thrown down, which must be purified by solution in alcohol. When gently evaporated, this solution yields prismatic crystals of corydalia. They are soluble in ether and alcohol, but slightly so in water; which latter circumstance renders it almost tasteless; but, in combination with an acid, it becomes very bitter. Its salts are decomposed by potassa and soda.

Cynapia (Vegeto).—Professor Ficinus, of Dresden, discovered this alkali in the common fool's parsley. It crystallizes; is soluble both in alcohol and water, but not in ether. It forms salts with acids.

Dahuria (Vegeto).—This alkali was discovered by Brandes. It is obtained from the seeds of the common stramonium, for which purpose, a pound of them are to be boiled in six pints of weak alcohol; the solution is then to be filtered while hot, and half-an-ounce of magnesia added. The mixture must be shaken frequently for twenty-four hours; the precipitate must then be collected and boiled again with twelve ounces of alcohol, then filtered through animal charcoal, which frees it from colouring matter; the solution has then to be evaporated to one-half, and set aside, when crystals of dahuria will be deposited. It is colourless; has an acrid bitter taste; is exceedingly poisonous; soluble in about eighty parts of boiling, and 300 of cold water; very soluble in alcohol. The salts of dahuria are generally permanent in the air, but are decomposed by soda and potassa.

Delphia (Vegeto).—This alkali was discovered in 1819, by MM. Fenslille and Lassainge, in the seeds of the staves-acre. To obtain it, a quantity of the seeds, deprived of their covering, and reduced to a fine powder, are to be boiled in a little distilled water. Strain the decoction and filter it; add pure magnesia, and boil it for several minutes; filter again; wash the residue with water, and submit it to the action of rectified alcohol; by evaporating the alcoholic solution, delphia, as a white powder, will be obtained. It exhibits a few crystalline points when moist, but soon becomes opaque by exposure to the air. It has no smell; its taste is at first extremely bitter, then acrid. It is slightly soluble in water; but alcohol and ether dissolve it abundantly. By M. Coerbes's analysis, delphia consists of

Carbon	76.69
Nitrogen	5.93
Hydrogen	8.89
Oxygen	7.49
	99.00
Loss	1.
	100.00

It forms neutral and soluble salts with sulphuric, nitric, hydrochloric, oxalic, and acetic acids.

SEPTIMUS PIESSE.

THE CHEMICAL WEATHER-GLASS.

TAKE a bottle, about ten inches long, and three-quarters of an inch in diameter, fill it with two drachms of camphor, half-a-drachm of purified nitre, and half-a-drachm of muriate of ammonia (sal ammoniac), pulverized, and dissolved in two ounces of proof spirits. The mouth of the bottle is to be covered with paper, or a piece of bladder perforated with a needle.

If the weather promise to be fine, the solid matter of the composition will settle at the bottom of the tube; but, previously to a change for rain, the compound will gradually rise, the fluid will continue transparent, and small stars will be observed moving or floating about within the vessel. Twenty-four hours before a storm or very high wind, the substance will be partly on the surface of the liquid, apparently in the form of a leaf; the fluid in

such case will be very turbid, and in a state resembling fermentation.

During the winter, small stars being in motion, the compound is remarkably white, and somewhat higher than usual, particularly when white frosts or snow prevail; on the contrary, in the summer, if the weather be hot and serene, the substance subsides closely to the bottom of the tube. Lastly, it may be known from what point of the compass the wind blows, by observing that the solid particles adhere more closely to the bottom on the side opposite to that where the tempest arises. E. LEDGER.

To the Editor of the Mechanic and Chemist.

SIR,—I cannot admit the justness or correctness of your remarks in page 291. I have never attempted to persuade anyone, "that two lines near together, and each pointing to the north, are not parallel." They clearly are. But that has nothing to do with the question. Your remark, that "W. N. appears to forget that the light was to be *continually* due north of the traveller," is made in error; for, by the question, it is only stated that the light, *when first observed*, is due north of the traveller; and, as the light moves eastward, the direction of the light from the traveller (who, by the question is to be *continually* travelling towards *it*, i. e., *the light in motion*, and *not* continually keeping the light due north), will only be due north at the moment he first observes it, and will be in a direction more and more eastward, until he comes up with it.

W. N.

[Upon the conditions above explained, the question is open for another solution. It was supposed by "L. L.," that it was required to keep the light due north, and it was upon that understanding that we pronounced his solution correct.—ED.]

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, May 13, Dr. Epps, on Phrenology. Friday, May 15, C. Johnson, Esq., on City Gardening. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, May 14, J. L. Bicknell, Esq., on Great and Small. At half-past eight.

Poplar Institution, East India Road.—Tuesday, May 12, J. Bennett, Esq., on the Press. At eight o'clock precisely.

Tower Hamlets Chemical and Philosophical Society.—Next Wednesday evening, May 13, a Lecture will be delivered on the Steam-engine. At eight o'clock. Persons wishing to attend any of the Lectures before becoming members, may obtain an order by applying to Mr. Jeffs, 81, Shoreditch, H. Wiglesworth, or any of the Committee.

QUERIES.

Assuming that the fulcrum upon a railroad is $\frac{8}{200}$th of the weight, and that, on a level part, the wheels of the engine-carriage will not slide, so long as the power requisite for drawing the trains does not exceed $\frac{1}{20}$th of the weight of the engine, what will be the greatest inclination at which the train can move? P. A.

1. What is the best out-door paint? 2. Can the (black) oil tar be so affected, that it shall deposit its colour, and be rendered efficient for out-door painting? 3. The best method of making blacking-paste? A receipt for corium panium (I believe so called)? 4. The way to make permanent ink for linen, without the use of the ordinary pounce? 5. The varnish or polish used for ladies' shoes? J. R.

1. A receipt for making the best kind of liquid blacking for boots, shoes, or harness? I have no doubt that, among your numerous and scientific correspondents, there are many who have in their possession private receipts for making blacking equal to Day and Martin, Warren, Everett, or Langley; and I shall esteem it a favour, if some person will supply me with a receipt in an early Number for making blacking that will not injure the leather, and that will produce a brilliant and permanent jet polish. 2. The best preparation for hastening the germination of seeds? I have been informed that mustard and cress have been sown, grown, and gathered, in the course of a few hours, after the seed had been steeped in some chemical preparation; and I have also been informed, that either aqua vitæ, oxygenized muriatic acid, or phosphate of ammonia, will answer the above purpose; and shall feel obliged if some persons will inform me in what proportion either of them should be used, and what length of time the seed should be immersed? 3. A receipt for making a polishing-powder for cleaning and instantly removing stains from silver, brass, copper, Britannia metal, steel, &c.? 4. A receipt for making a mixture for enticing and destroying rats and mice in dwelling-houses, farm-yards, &c., that will be eagerly devoured by the above vermin, but that will do no harm to children or domestic animals? N. M. T.

1. A receipt for making the best kind of blacking for boots and shoes? 2. A receipt for making artificial yeast? 3. What is the oil of rhodium made of, and how is it made? 4. The best method of tempering mill chisels, and of performing the work? 5. A receipt for making a mixture that will make hair curl? 6. To make the best powder for cleaning and preserving the teeth; and also a receipt for making a tincture that will effectually cure the toothache? 7. A re-

ceipt for making a varnish for harness, &c., that will produce an instant and durable polish without brushing? 8. The newest and most approved book on practical banking and commercial book-keeping? 9. The best work on making varnishes of all kinds? 10. What is pilul. rhei. comp. made of, and how is it made?

OBLIVISIE MENON.

1. Is there any work published on organ-building? Or can anyone furnish me with a scale for making small diapason pipes, either stopped or open? 2. Wanted a receipt for making what hair-dressers call "botanic wash," and "vegetable extract?" 3. Where can I purchase Murray's "Atramentum Permaneo?"

GEORGIUS.

1. How to deposit any salt which may be in the juice of fruit, as cream of tartar in the juice of the grape, &c.? 2. Is the saccharine acid different to the acetous acid; if it is, in what does it differ? 3. What are the manipulations requisite to procure the vegetable acids, such as gallic, malic, oxalic, &c., in a state of purity from the different fruits, so as to ascertain the proportion of acid to a certain weight of fruit?

TYRO BOTANICUS.

ANSWERS TO QUERIES.

"P. A." "Light is stated to travel at the amazing velocity of 192,000 miles in a second of time; how is this ascertained?"—It is proved by the eclipses of Jupiter's satellites; the motions of which satellites are well ascertained. When the earth is in that part of her orbit nearest to Jupiter, the eclipses appear about sixteen minutes sooner than they do when the earth is in that part of her orbit farthest from Jupiter; and, as the diameter of the earth's orbit is nearly 190,000,000 miles, it follows that light travels nearly 12,000,000 miles in a minute, or about the rate mentioned by "P. A."

"How is it, that, on the equilibrium theory, in north latitude, the day tides are higher than the night tides during summer, and lower during winter?"—Because in summer the sun and moon having north declination will, in north latitudes, attain a greater altitude (and be a longer period) above the horizon than in winter; consequently, the moon's attraction of the waters will be greater, and in a more perpendicular direction than in winter; and the day tides will, therefore, be greater than the night tides; and the reverse of this will take place in winter, as the moon will then have south declination, and the day tides will then be greatest in southern latitudes.

W. N.

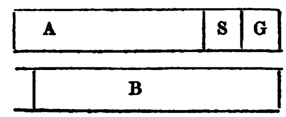
"An Amateur Jeweller" will find, after he has cut his garnets to size on a pewter lap, with fine flour emery, that he can polish them on a copper lap with rottenstone and water; but I should think that he can purchase them much better at Meage and Davis's, St. Paul's Square, Birmingham.

A. ADAMS.

Cure for Chapped Hands.—It will be found, generally, the common camphor soap sold by perfumers, will be the most agreeable and effectual; or, instead of washing the hands with soap, employ oatmeal, and, after each washing, take a little dry oatmeal, and rub over the hands, so as to absorb any moisture.

J. R.

To make Waterloo Crackers.—Take a slip of cartridge-paper, about three-quarters of an inch wide; paste and double it. When it is quite dry, cut it into two equal lengths, as A and B in the



pattern. When you have proceeded thus far, glue or gum the paper slips in the part marked G in the pattern, and on it strew a little powdered glass; then put about a grain of fulminating silver on the part marked S, and while the glass composition is moist, put the paper, marked A, over the farthest row of glass. Over all, paste twice over the part that covers the silver a piece of paper; let it dry. When you wish to explode it, take hold of the two ends, and pull them sharply from each other, and it will produce a loud report.

E. LEDGER.

TO CORRESPONDENTS.

K. W. S.—*The matches he describes, appear to possess the same properties, and are, probably, identical with the common congreves; although, for some commercial object, they are christened "oxyhydrogenical."*

Inquirer.—*A water-pipe conveyed* under *an obstacle, in the form of an inverted syphon, is in no respect superior to the other arrangement he describes, in which it is carried* over *the obstacle.*

H. M.—*Gerard's lamp is constructed on the same principle as the fountain. The oil is forced up the wick by the pressure of the oil in the lower compartment, in the same manner that the water is forced out of the fountain by the pressure of a higher column of water. It is unimportant whether the upper compartments be placed one above the other, as in the lamp, or one at the side of the other. The pressure, and, consequently, the height of the jet, depends solely upon the height of the incumbent column, the capacity of the vessel affecting only the duration of action with one supply of water. We should recommend about eighteen inches diameter for his fivefect basin. If agreeable to our correspondent, we should like to see it.*

F. Cobbett.—*When a person stands in a scale, and receives an additional weight, either holding it in his hand, swallowing it, or disposing of it in any way so as to be incumbent on his person, or on some object supported by his person, an equivalent weight must be added to the opposite scale, to preserve equilibrium.*

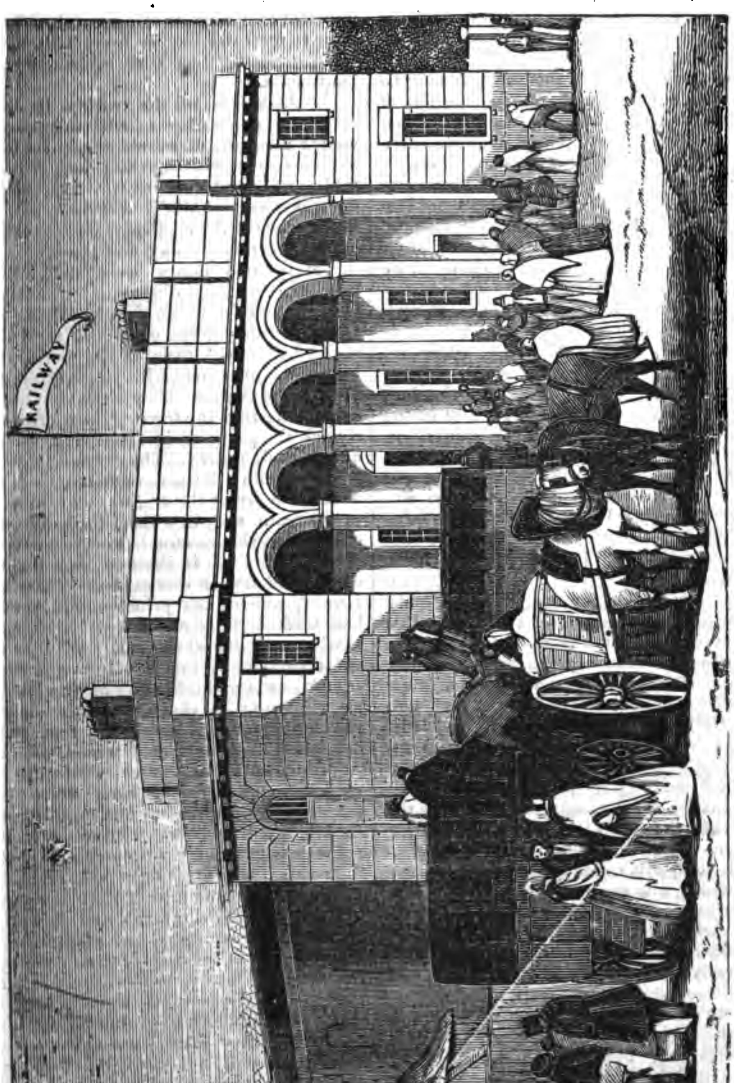
London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 92, NEW SERIES. | SATURDAY, MAY 16, 1840. PRICE ONE PENNY. | No. 213, OLD SERIES.



VIEW OF THE ENTRANCE TO THE LONDON AND SOUTHAMPTON RAILWAY.

 City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

LONDON AND SOUTH-WESTERN RAILWAY.

In our front page is a view of the London entrance to this great and valuable work. The line of communication between London and Southampton is completed, and was opened to the public on Monday, May 11. This affords another, and, beyond all doubt, a finer and more delightful outlet from the metropolis, than any that modern ingenuity and enterprise have yet afforded. Journeying by railway, we measure distance, not by miles, but minutes; and, adopting this scale, it may be safely said, that Southampton, the Isle of Wight, and the charming neighbourhood of the New Forest, are now little more distant than Gravesend, and considerably more within our reach than Ramsgate and Margate. The traveller, urged by business, or the tourist, seeking change, taking his seat at Nine Elms at eight o'clock in the morning, is gladdened by the smiling beauties of "the island," or plunged in the depths of the New Forest, before the chimes of town or village steeples in these far-off and delicious regions ring out the hour of noon. Three hours of easy travelling bring him half way down the Channel, place him in the midst of the most charming scenery in England, or set him well on his route to Paris. Henceforth the relations between Southampton and London are changed; nor can the time be distant when the magnitude and national importance of the change will be as fully appreciated as they are manifestly apparent. Some of the directors, and a large party of their friends, made an excursion along the whole line on Monday, starting from London at eight o'clock, and reaching Southampton, after several long and somewhat wearisome stoppages to increase, at different stations, the freight of passengers, at half-past eleven. And here we cannot but express our regret, that the chairman and several of the directors were prevented from being present, by the necessity of attending the proceedings in the Vice-Chancellor's Court, arising out of the opposition of a joint-stock company, called the Northam Bridge Company, who are endeavouring to obtain an injunction to stop the traffic of the railway within a mile of the terminus at Southampton. That any Company, whose interests are identified with Southampton, should so misconceive their own, and so blindly seek to impair those of the town, by throwing obstacles in the way of this undertaking, appears marvellous; and when it is considered that the Northam Bridge Company is composed of many of the leading gentlemen in Southampton, their conduct cannot fail of exciting general surprise. But we return to our description of yesterday's occurrence. The importance of the occasion seemed to be fully felt by the inhabitants of the neighbouring county, even from Wandsworth to the termination of the line; for, at every resting-place, thousands had assembled to greet with lusty cheers the art-impelled and rapid-moving carriage hereafter to diminish, by at least two-thirds, the distance between them and the world's metropolis.

On the arrival of the train at its destination, a deputation of the townspeople waited upon the directors to request them to fix a day for visiting the town, and partaking of an entertainment. The compliment was very cordially received, but, in the absence of the chairman and a portion of the directory, no day was fixed.

Nearly two hours were delightfully loitered away at Southampton—the speculative attracted to an inspection of the works actively going on in the formation of the docks—the lovers of the picturesque hastening to snatch a hasty glance at the beauties of Netley Abbey—the simply idle sauntering into the town. Soon after one o'clock the party again assembled, and set out on their return. The "smokin', boilin', screamin', bustin' monster," as Mr. Weller describes the engine, was attached to the train, and, in a short three-quarters of an hour, the venerable towers of Winchester were left in the rear, and the Andover-road station was gained. Here Mr. Brassy, one of the principal contractors, had made arrangements, upon a most extensive and liberal scale, not only for the entertainment of the directors and their friends, but for the feasting of the labourers employed in the construction of the works. Marquees, amply set forth with delicate viands and rare wines, afforded refreshment to the former, while the latter were made happy by lusty slices from the sides of a roasted ox, and an unlimited supply of strong beer. The scene at this point was extremely animated and cheering. The gay streamers that flaunted from the spiral summits of the marquees—the branches of evergreens and flowering shrubs that embowered the station-house —the throng of smartly-dressed visiters—the host of hardy, well-washed, merry-looking labourers—and, though last not least, the numberless groups of healthy, buxom country lasses, presented a *coup d'œil* that will not easily be forgotten. When due honour had been paid to the

good cheer under which the tables groaned, a few toasts naturally suggested themselves. Among these was "Success to the London and South-Western Railway," which was received with the warmest enthusiasm. Then came the health of "The Chairman, Mr. Easthope," with an expression of regret at his absence. This also was most cordially received. Mr. Loch, the engineer, received a similar compliment; and the health of Mr. Brassy, the contractor, whose spirited and praiseworthy conduct appeared to be the theme of general admiration, was cheered to the echo. It was now growing late, and people began to remember that they were still nearly sixty miles from home. The carriages again received their well-pleased burden—the engine's noisy whistle proclaimed that all was right—a cheer from the by-standers marked the first tremulous motion of the train—a moment afterwards the scene receded beyond the vision's scan, and, in little more than two hours, the party were safely deposited in London. In these rapid transits, it is not easy to observe the remarkable and often stupendous works by which our progress is facilitated, and which, in the instance of this railway, have been undertaken and executed with unexampled rapidity. No one, however, can fail to be struck with the cutting at Popham Beacons, near Winchester, and the embankment at Micheldever, which, among works of their kind, are of a magnitude that is without a parallel. We have shown that the train by which the party was conveyed, occupied three hours and a half in the completion of the journey. But that which is technically called the "first train" (and, it would seem, that it has a literal claim to the title), and which started two hours later (at ten o'clock), accomplished the whole distance (seventy-five miles) in two hours and fifty-six minutes, reaching Southampton at four minutes before one o'clock. We have great satisfaction in adding, that there was not an accident, even of the most trivial nature, to mar the enjoyment of the day.

We are indebted to the *Morning Chronicle* for the foregoing lively and interesting account of the proceedings of that memorable day.

The New Floating Bridge, which has just been opened for the purpose of plying between Portsmouth and Gosport, carried, during the last week, 600 vehicles and 8000 passengers. On Monday last, the number of passengers was 7600.

MR. MATHEW'S PADDLE-WHEEL.—PIRACY BY ACT OF PARLIAMENT.

To the Editor of the Mechanic and Chemist.

Sir,—I have just seen the specification of Mr. Hall's "Reefing Paddle-wheel." It is a piece of consummate impudence—a day-light robbery, by taking possession of other men's ideas, and yelping them as his own. I would have addressed these remarks to the publication containing the specification; but, having wrote twice to that work early in 1837, on the subject of my invention, which received no attention; the editor, in explanation, said, that there were so many paddle-wheel inventions that did not answer the purpose, and so many communications upon the subject, that they were not worth attending to. I wrote again on the 10th of April last, on the subject of my invention, claiming priority to Mr. Hall, which met the fate of the two first letters. Thus have I been treated by the "Mechanics' Magazine;" I have reason to add, an encourager of unprincipled monied men's plagiarism of poor men's inventions.

I cannot do better than to give the editor's opinion of the claims made by this gentleman pirate:—"We must confess that we are greatly startled and amazed, and cannot go half—nay, nine-tenths of the length, which he *insists* we ought to go." And, in explaining the similarity of principle in Mr. Hall's patent, and that of a prior patent taken out by a Mr. Holebrook, continues, "Mr. Hall has forced the matter on our attentive consideration by the terms of his claim—far stretched, wide-sweeping, and ultra-possessive beyond any claim we ever read;" and, "why, if this claim could stand good, then Mr. Hall's patent would put an extinguisher on Mr. Holebrook's plan, which depends, as much as Mr. Hall's does, on the employment of inclined incurvated eccentric surfaces." If any discovery similar to mine had been made previously to my interview with Mr. Field, that gentleman would have known it, and would have given us that information, Mr. Holebrook's plan being merely an improvement upon "Morgan's wheel," (the specification and drawing I have before me,) consisting of "inner and outer framing, star wheels, &c.," and the publication of his specification being December 8, 1838, does not in the least affect my invention, either as to priority or principal, however it may affect that of Mr. Hall's; perhaps their greatest resemblance is their peculiar complication. I claim to be the first in the

field with the sliding paddle-board, and claim it as my invention. The "Columbus's egg" does not belong to Mr. Hall. It is, therefore, a base robbery to deprive me of a fair portion of the benefit to be derived from its use. Mr. Hall's plan is to regulate the depth or dip of paddle-board, agreeably to the depth of water the vessel may draw, in order to sustain surface propulsion, not being able to overcome the increased resistance at the front and back of the wheel at a greater depth of submersion. Thus, if a vessel has a cargo of 500 tons, the paddles, propelling at the extremity of the wheel and at the surface, making the longest horizontal stroke of paddle encountering the least resistance, the cargo is increased to 1000 tons; the vessel draws more water; resistance is increased on that account. She is exposed in a "rough sea or violent weather," so that her engines are paralyzed; in towards the centre of the wheel creeps the paddle-boards, suspended and carried round by means of rods attached to the paddles, and connected with the inner groove or grooves, when they describe a smaller circle, making a shorter horizontal paddle-stroke, and spinning round with increased velocity, keeping up the power of the engines to consume steam and fuel, and thereby obtain increased power (so we are told by a great authority); the vessel will now "move in spite of the mighty power of the ocean, and powerfully and majestically away from lee-shores and rocks."

Your obedient servant,

THOMAS MATHEWS.

14, Portland St., Wardour St., Soho,
May 11th, 1840.

[If an injured man is deprived of legal redress, it is only fair that he should be allowed an opportunity of expressing his complaint; we therefore insert his letter *verbatim* as we receive it. We have always been professed, and intend to become *active* enemies to the oppressive patent laws, and we attribute to those laws, rather than to the individual, or to the publication of which he complains, the injustice under which he is suffering. At a future time we shall bring this case before the public, as one of the many examples of unfairness in the operation of the present *detestable* patent laws.—ED.]

VERDAN'S KALOSCOPE.

To the Editor of the Mechanic and Chemist.

SIR,—As I was making frames for two sheets of perforated zinc, for the purpose of drying plants between them, I was extremely surprised, on applying carelessly one of the sheets to the other, to see, instead of round holes, a series of stars formed by the different combinations of the holes of the two sheets of zinc, with respect to each other. I observed afterwards, that these figures may be changed into a great number of others, by moving the two sheets on each other; and, in order to have a better view of the effect, you may place yourself in the sunshine, holding in one hand the two plates of zinc, and, in the other, a sheet of white paper; by interposing the two former between the sun and the latter, on which the image is thrown, the experiment will be found highly interesting. The figures vary, likewise, according to the distance at which the zinc and paper are placed from each other. I think that holes of any other form, though regular in their distribution, and combined in the same way with others, either different, or of the same shape, would produce very curious and interesting effects; and photogenic paper might, perhaps, be employed with advantage to render these effects permanent.

D. VERDAN.

Twickenham.

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(Continued from page 285.)

LUTTERWORTH is a market town in the county of Leicester, 90 miles from London, 12 from Leicester, and seven from the Rugby Station. It is situated on the river Swift, near the junction of that stream with the Avon. Many of the modern houses are built of brick, but the more ancient are chiefly composed of mud and straw, little superior, except in size, to the architectural productions of the feathered denizens of the air. The church, dedicated to St. Mary, is a large and handsome structure, with a fine tower, formerly surmounted by a spire, which was fifty feet higher than the four turrets which now supply its place. It was blown down in a storm which occurred in 1703, and greatly injured the body of the church by falling on the roof. In 1740 the whole was repaired, and all the interior made new, except the fine old oak pulpit, which is preserved with much veneration, in memory of Wickliffe, the great Reformer of the fourteenth century, who was rector of this parish, and died suddenly in the church in 1387. His portrait by Fielding, his table, gown, and

the chair in which he died, are also preserved and shown. Wickliffe was the first priest who openly opposed the authority of the Pope and the bishops, and he was, in consequence, much persecuted. Forty years after his death, his bones were dug out of his grave and burnt, and the ashes thrown into the Swift, by order of the Council of Sienna. The inhabitants of Lutterworth were formerly subjected to the oppression of an absurd law, which compelled them to grind all their corn at one particular mill, and all their malt at another. The question was, however, tried in 1758, at the Leicester assizes, and decided in favour of the inhabitants, empowering them to erect mills and grind corn where they pleased.

A market is held on Thursdays, and fairs on the Thursdays after February 19, March 10, April 9, July 23, and Oct. 10; also on Holy Thursday for horses, cows, and sheep; and September 16, for cattle and cheese. The cotton, worsted hose, and riband manufacture constitutes the principal trade of the place.

MARKET HARBOROUGH is a market town in Leicestershire, 83 miles from London. It is situated on the southern border of the county, on the river Welland, and the Leicester Canal also passes through the town. It contains a spacious and handsome church, dedicated to St. Dionysius, a stone bridge over the Welland, a handsome market-house, and places of worship for Dissenters of various denominations. There are many vestiges which prove that this place was occupied by the Romans; and it is supposed, by some historians, to be of still more ancient origin. King Charles I. had his head-quarters at this place previously to the battle of Nazeby, and the giant Cromwell afterwards wrote a letter dated from Harborough, and informing Parliament of his victory. Carpets are manufactured at this place, and considerable business is transacted at the fairs.

Bilton is a village about a mile and a half from Rugby. The chief attraction of this place is the mansion called Bilton House, which was purchased in 1711, of William Broughton, Esq., by that elegant and universally-admired writer, Addison, for the reception of his bride, the Countess Dowager of Warwick. Several of the apartments are preserved nearly in the same condition as when he occupied them.

At Rugby, the road is carried on an embankment, which extends nearly two miles; in some places, from thirty to forty feet high. About 105,000 cubic yards of earth were required for its erection. The road from Rugby to Lutterworth is crossed by a beautiful bridge of five arches, and alternate cuttings and embankments, carrying the line to

BRANDON STATION, an intermediate one, 89¼ miles from London, 23 miles from Birmingham; from whence, triumphing over every inequality of surface by means of cuttings and embankments of vast dimensions, the road is carried to

COVENTRY STATION, 94 miles from London, 18¼ from Birmingham. Here we must pause to survey the renowned and important places which surround us.

LONDON JOURNEYMEN'S TRADES' HALL.

ON Monday, 11th instant, an adjourned public meeting was held at the Mechanics' Institution, Southampton Buildings. As on the former occasion, the professional spouters were all of the ultra-radical class; but they were less eloquent than several of the speakers announced as working men. The greatest harmony, and almost unanimity of opinion prevailed upon most of the topics propounded by the speakers. Mr. Leader denied that the presence of himself and colleagues on the platform did honour to the meeting. He said that they were labouring men themselves; and if poor men had their troubles and privations, rich men had also their cares and anxieties, as well as their labours to perform; the meeting, however, pronounced this to be "gammon," and appeared to feel no commiseration for distress in an arm-chair, surrounded with luxuries, nor for the harassing cares of a man with five thousand a-year, grief-worn because he cannot make it six thousand. Mr. Roebuck said, that the working classes of London, though numerous, were weak, because they were not united and guided by intelligence. Chartism, Socialism, Teetotalism, and useful instruction, all found able advocates; Chartism, however, was received with the greatest favour. We regret that the report of the Committee, and the resolutions of Monday evening, have come to hand too late for insertion this week; but they will appear in our next.

THE CHEMIST.

ANTIDOTE TO ARSENIC.

THE following facts respecting a newly-discovered antidote to arsenic, merit the serious attention of our readers:—

The efficacy of the hydrated peroxide of

iron in counteracting the fatal effects of poisoning by arsenic, has already been made public; but a sufficient number of facts have not been furnished, so as to leave no doubt upon the certainty of its action as a specific against arsenical preparations; but the following seven cases remove all incredulity upon this important acquisition, conferred by the progress of chemical science, and which, for the sake of humanity, cannot be made too public; as it is now incontestibly proved, that the peroxide of hydrated iron is the most certain, safe, and ready antidote against arsenic known.

On the 9th of October last, Dr. Puchelt, of Berlin, was called to attend Charlotte Lenz, aged thirty-five, who had been taken suddenly ill after dinner. He found the patient of a death-like paleness, her features contracted. She had trembling fits; her pulse was small, frequent, and almost imperceptible to the touch. She suffered also from constant vomitings, accompanied by violent spasms in the region of the stomach. The abdomen was contracted, and little affected by pressure; the tongue pale, but slightly coated.

The patient stated, that she had dined at the house of a neighbour, named Baner, and with three of his children; she had herself cooked the dinner, as the man's wife was not at home. In a quarter of an hour after partaking of some soup, she became so ill, that they were obliged to carry her home. Dr. Puchelt repaired to the house where she dined, and found the three children and the father extended on beds, and apparently in the agonies of death. One of the children was fifteen months old, the second three years and a half, and the third five years. They were all seized with illness shortly after partaking of a few spoonsful of the soup. The father, who took two soup-plates full, and some meat, went to work after dinner, but was obliged to return immediately, in consequence of the violent pains and spasms with which he was seized. He, as well as the children, exhibited the same symptoms as the female above alluded to. After some inquiries, the medical attendant ascertained that Charlotte Lenz had taken, in mistake for flour, a spoonful of arsenic, kept for destroying rats, and incautiously left in the cupboard.

Dr. Puchelt had fortunately provided himself with some peroxide of hydrated iron, and immediately administered a large spoonful to the father, and a smaller quantity to the children. He then returned to the lodgings of Lenz, and gave her a similar portion of the peroxide of iron. Five minutes after the first dose, Baner, the father, vomited; a second dose (spoonful) was then given, and he became calmer. The children also vomited, but, on taking more of the peroxide of iron, they were soon relieved, and the two youngest fell asleep. At half-an-hour after the first dose, an aperient effect was produced upon the father, and the symptoms were considerably diminished, the uneasiness and violent colics ceased, and the countenance assumed a natural appearance. The female Lenz was also relieved after the first few doses.

In the evening, Baner and the two youngest of the children were in a satisfactory state; but Charlotte Lenz, who had been previously ill, and the eldest daughter, who had taken very little of the antidote (having obstinately refused), were not so much recovered as the others; another spoonful was accordingly administered to each. On the following morning Baner was able to resume his work, and the two younger children had quite recovered. The eldest, however, was still paler, and complained of uneasiness; the abdomen was swollen and tender, and the tongue coated; but what she particularly suffered from, was a violent palpitation of the heart, which came on at intervals; this palpitation was easily heard by the stethoscope, but by no means in unison (synchronous) with the pulse, which continued small. A sinapism was applied to the region of the heart, and another dose of peroxide of iron administered, as also to the female Lenz, who exhibited the same symptoms. Aperient medicine was given in the evening, and with effect; next morning they were both much better, the palpitations had subsided, and the pulse became strong, the appetite returned, and in the course of a few days the cure was perfected.

On analyzing the portion of the soup left, it was found to contain a quantity of white oxide of arsenic. The matter ejected from the stomach was also analyzed, and showed the presence of arsenic; in the portions mixed with the peroxide of iron (taken as the antidote) it was ascertained that the peroxide was changed into the arseniate of iron; thus establishing its claim as a specific. Two other cases are detailed, in which two children, one eight years and the other ten years old, had swallowed half-a-spoonful of arsenic, mixed by mistake in some vegetables; they were instantly seized with symptoms similar to the above. The peroxide of iron was administered six hours after the accident, and was attended with complete success.—*Medicenische Annalen.*

MISCELLANEA.

Turning Lathes.—At the ordinary meeting of the Society of Arts on Wednesday, the large silver medal was awarded to Mr. J. Hick, jun., of Bolton, for an improved expanding mandrel for turning lathes. It is necessary that a mandrel should fit so accurately, as to bite on the inner surface with a force sufficient to counteract that of the tool, and, in the ordinary mode, the same mandrel cannot be used for two pieces which are of different diameters. Consequently, in many engineering establishments, a stock of mandrels is kept, amounting to 600 or 700. Mr. Hick purposes to do the same work with eight sizes of the mandrel, from one inch and a quarter to ten inches. He effects his object by having the spindle of the mandrel shaped on the frustrum of a cone, on the face of which are four dove-tail grooves to receive wedges, the under faces of which have the reverse inclination of the cone; so that the lines of their outside faces are always parallel with the axis of the mandrel. A nut is screwed on the spindle, which acts on the wedges through the medium of a conical cup, which drives them up to their bearings inside of the work.

Steam-boilers.—At the last sitting of the Society for the Encouragement of National Industry, and on the report of M. Seguier the younger, a gold medal was decreed to the elder M. Chaussenot, for an apparatus to render the explosion of steam-boilers impossible. According to the report, his invention is perfect, both as regards its improvements on the safety-valve, and an ingenious contrivance to give notice to the crew and passengers of impending danger. Even the contingency of wilful mischief is provided against; as, in the event of all the warnings of his machinery failing, or being disregarded, the steam flows back upon the furnace, extinguishes the fire, and destroys all possibility of an explosion.

Society of Arts.—After the lecture on Wednesday, Mr. Smee exhibited his new galvanic battery. The elements of the battery were silver and zinc, and the exciting fluid dilute sulphuric acid. So far there was nothing new or uncommon; but the negative plates were not simply silver, but silver platinized, by having a layer of that metal deposited on their surfaces by galvanic agency; thus creating an immense number of points from which the hydrogen might be thrown off, and, at the same time, insuring complete contact with the exciting liquid. Mr. Smee stated, that the advantages of this battery were, the cheapness of the exciting liquid, the little trouble it required to keep it in order (for, when done with, it only required to be taken out of the acid, and it is ready for use at a minute's notice), and the absence of all injurious fumes. There is an immediate cessation of action in the cells when the circuit is interrupted, which prevents any waste of the material when the battery is not in use.

The Burning Coal Mines of Commentry.—This extensive and destructive fire has been incessantly burning from 1816 to the present time, without making any great apparent progress, recently, as described in a former Number. The mayor of the commune writes as follows to a Paris journal:—" The mines of Commentry are worked at once subterraneously and beneath the open sky. Of late years, this second mode has been preferred. A seam, extending to 80,000 cubic *metres* had recently been exposed, and was about to be carried off, without any apprehension of the fire, which, in fact, has existed in these mines during the last four-and-twenty years, but the seat of whose action was at some distance from the mass in question, and was, besides, confined by important works of art. No danger seemed to present itself in that direction; yet an active an unceasing watch was maintained night and day. All possible precautions had thus been regularly taken. On the 15th of March last, a huge fall of earth, which no vigilance could foresee, suddenly occurred, throwing down the barriers established, and driving their guardians before it. The director of the mines immediately descended into the works, caused the safety-gates to be closed, and endeavoured to bar all access to the air. But the fire, bursting through every obstacle, spread with instantaneous and devouring force over the great coal seam, which was soon in full combustion. The civil and military authorities were immediately on the spot, and rivalled each other in zeal and activity. They were accompanied by the engineers of the roads and bridges, and those of the mines; who declared, that a great and continuous body of falling water was the only power capable of subduing the conflagration. But the river flowed thirty-eight metres beneath the coal-field. A minute survey of the ground was, however, made; and established the possibility of turning the course of a tributary stream, which flowed at a distance of 4300 metres. The work was instantly commenced; the ground-formations for the bed of the deviation occupied forty-eight hours; and twice that interval of time sufficed to execute and arrange in their places certain wooden conduits, destined to traverse several intervening hollows. At length the waters so impatiently expected, arrived, pouring into the burning mine 2000 cubic metres of water per day. At the present moment, all the subterranean works are under water; and, since the commencement of this month, a system of irrigation has been established on the burning mass, which has produced the happiest effects. Hopes are entertained that, in time, not only will the immediate conflagration be extinguished, but that also which has been in operation for twenty-four years past.

New Mouth of the Vistula.—[*From a Correspondent of the " Morning Chronicle."*]—In consequence of the early breaking up of the ice in the Vistula, and the flood occasioned by the late heavy rains, the river was choked up a mile and a half above the city of Dantzic, whence it takes its course to the westward. The left bank of the river is here bounded by a dyke, which protects the fruitful low country behind it; the right bank is, however, without any such artificial protection, because its immediate neighbourhood consists of unfruitful sand land, and of a road of sand-hills or downs, for a distance of several German miles, which separate the river from the sea in such a decided manner, that it never appeared possible to any one, that from that side any danger was to be apprehended from the water in the Vistula. But it happened, on the night of the 31st of January, when it was expected that every

moment the water would run over the dykes on the left bank of the river, and produce a most dreadful inundation, that the stream, encumbered with heavy masses of ice, took its course over the right bank, and attained the sand-hills. These being from forty to sixty feet high, stopped the water, but the current undermined them just at the place where those hills merely consist of loose sand, and are the narrowest. As soon as they gave way, the accumulated mass of water and the heavy ice, found their way through this new opening with indescribable force, and made a broad and deep channel into the sea. To stop this new natural mouth is impossible, and, if it could be done, no one would feel inclined to do it. About thirty years ago, the plan was proposed by members of the Government, to form exactly the new mouth for the river, which has just been made by a natural cause. Thus a great expense has been saved, and a great benefit operated at the same time, by this occurrence. As regards the influence which this event may have on the communication of the town of Dantzic with the Port Fairwater, and also with Poland and the interior of the country, there is not the least ground to apprehend any interruption. We by no means lose the navigableness of the old Vistula, which, henceforward, as before, will bring the Polish barges and the timber transports to our town. Its depth is likewise sufficient in its whole length to bear vessels of the same magnitude as before. Neither does the occurrence make any change whatever in the communication of that town with the sea-port.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, May 20, D. Ziliani, Esq., on the Italian Literature of the 16th Century. Friday, May 22, C. Johnson, Esq., on City Gardening. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, May 21, C. H. Purday, Esq., on Music. At half-past eight.

Poplar Institution, East India Road.—Tuesday, May 19, Rev. W. Vidler, on Natural History. At eight o'clock precisely.

Tower Hamlets Chemical and Philosophical Society.—Wednesday, May 20, a Lecture on Chemistry. At eight o'clock.

⁂ Persons wishing to attend any of the Lectures before becoming members, may obtain an order by applying to Mr. Jeffs, 81, Shoreditch, H. Wiglesworth, 65, Tooley Street, or any of the Committee. The means which are proposed for carrying out the objects of the above Institution, are the following:—1st. A general meeting of the members will be held every Wednesday evening for the delivery of a lecture, the reading of a paper, or the opening of a question for discussion. In general, the lectures will be delivered, and the papers read by the members. It is considered advisable, that both political and religious subjects, as tending rather to irritate than convince, be entirely excluded, both from lectures and discussions. 2nd. A Library will be collected for the exclusive use of the members, as soon as the funds of the Society will permit. 3rd. Classes and sections will be formed for the study of Chemistry, Natural Philosophy, the Languages, Mathematics, Geology, Drawing, Vocal and Instrumental Music, &c., and Philosophical Apparatus provided for the use of the lecturers and members. The meetings for the present will be held at the Infant Schoolroom, 236, High Street, Shoreditch; but the Committee desire expressly to state, that they intend to remove, as soon as possible, to a more eligible situation. Members' Tickets, Prospectuses, with every information, may be obtained after any of the meetings of the Society, on application, by letter or otherwise, to Mr. Jeffs, or to Mr. H. Wiglesworth, 65, Tooley Street.

QUERIES.

A receipt for the best mode of cleaning paintings? B. R.

How to make pink saucers? X. Y.

If I take a lever 12 inches long, suspend one end, as in the safety-valve, and load the other end with 8 lbs., what weight will a point in the centre have to sustain, reckoning the weight of the lever as nothing? J. C.

How to make a good pastile, bottle lemonade, lemonade powders, ink, blacking, and bottle ginger-beer? J. W. K.

The best method for improving the colour of honey, and to set it firm in warm weather when thin? To take the colour out of cucumbers, and make them quite white? Z. O.

The most accurate and expeditious method of grinding and polishing lenses of all kinds, with directions for making the tools and machinery, and the best materials for grinding and polishing? S. H. T.

TO CORRESPONDENTS.

Q.—*The best way to clean dead gold articles is, to brush them with a fine brush (according to the delicacy of the object) with soap and hot water.*

J. C——y (Dungarvan).—*The solution of his problems may be found in any elementary work on mechanics. When a force acts obliquely on a straight lever, produce the line which represents the direction of that force, and draw a perpendicular to the fulcrum, or centre of motion; that line will be the length of effective leverage.*

Arthur Hodge.—*We decline answering any farther communications on the subject of his "improved flower-pots."*

J. S. *will find the receipt he requires in Vol. III., page 270.*

London: Printed at "The City Press," 1, Long Lane, Aldersgate, by D. A. Doudney (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. Berger, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 93, NEW SERIES. | SATURDAY, MAY 23, 1840. PRICE ONE PENNY. | No. 214, OLD SERIES.

WATER SEEN THROUGH A MICROSCOPE.

City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

MICROSCOPICAL DISCOVERIES.

(See Engraving, front page.)

THERE are few human inventions which have revealed more of the remote secrets of nature than the microscope; and the attention which it now commands from the learned, as a means of philosophical research and analysis, combined with the great improvements in the construction of the instrument, which are from time to time achieved, lead us to expect that it is destined to unfold many leaves in the book of nature, which have remained hidden from man since the creation.

Microscopes originally consisted of a single lens, or sphere of glass, or a minute drop of some transparent liquid; then comes mighty science, and the compound microscope is invented; and now, by the aid of chemistry, the very elements are subdued, and a light equal to that of the sun, is artificially produced. The most interesting, and the most wonderful discovery of the microscope, is the existence of living organized beings, invisible to the naked eye; creatures so minute, as to be imperceptible, even when magnified a thousand fold; and yet, not only endowed with the power of motion, but provided with everything necessary for their convenience and enjoyment. The same power that poised the mighty planets in the firmament, has provided for all the wants of the minutest, invisible, and nameless things that people a drop of water. The engraving represents the actual appearance of a drop of stagnant water, seen through any powerful microscope. The favourite element of these extraordinary beings, is water contaminated with corrupted vegetable matter; and different kinds of plants produce different species of animalcules; so that their varieties are innumerable.

We have received a notice of a microscope constructed on a remarkably simple principle, and well adapted for the examination of minute objects.

"This useful and ingenious microscopic lens is the invention of Lord Stanhope; both ends are ground convex, the one next the eye rather more so than the other. It has many advantages over the common lens; for instance, the difficulty of holding the hand steady to the focus, and the loss of light and small field attendant on viewing with a high magnifying power, are here obviated; for, the length of the cylinder being the exact focus, the object has only to be placed upon the end that is ground less convex, or to be brought in contact with it; when the advantage of great magnifying power will be obtained, with a field of nearly five inches—equal to many of the compound microscopes.

The portability of this instrument, its low price, and the facility with which it can be used, must recommend it strongly to all who use microscopic lenses. With it may be viewed the animalcules in water, mites in cheese, eels in paste and vinegar, the perspiration, human hair, farina and leaves of flowers, the hairs of animals, the down of moths, &c.; and, if a single drop of the crystallization of salts be spread lightly over the end of the lens, and viewed without delay, the formation of the crystals will be beautifully apparent."

ON THE EDUCATION OF THE WORKING CLASSES.

[WE have been favoured by our correspondent (Mr. Amer) with the following abstract of a lecture delivered, as he informs us, by Mr. Coombe. It is a subject which not only calls for the most serious consideration, but justice demands that every effort should be made to enable the working classes to participate, in some degree, in the advantages derived from machinery; it is an intricate problem, and certainly not practically solved by Mr. Coombe; but the mere mention of the subject, by attracting attention and eliciting suggestions, is a step towards its final accomplishment.]

The industrious classes constitute a vast majority of the population of Great Britain. The kind of education which they ought to receive, will depend on the objects which we assign to their lives. If they have been created merely to toil and pay taxes, to eat, sleep, and transmit existence to future generations, a limited education may suffice; but if they are born with the full faculties of moral, intellectual, and religious beings; if they are as capable, when instructed, of studying the works of God, of obeying his laws, and admiring his institutions, as any class of the community; in short, if they are rational beings, capable of all the duties, and susceptible of all the enjoyments which belong to the rational character, then no education is sufficient for them, which leaves any portion of their highest powers waste and unproductive. This is the light in which I regard them; and the grand question presents itself, What mode of life, and what kind of pursuits, are best adapted to the nature of man? In the present state of society, the industrious classes, or the great mass of the people, live in the habitual infringement of the most important laws of their nature. Life with them is

spent to so great an extent in labour, that their moral and intellectual powers are stinted of exercise and gratification; and hence their mental enjoyments are chiefly those afforded by the animal propensities; in other words, their existence is too little rational; they are rather organized machines, than moral and intellectual beings. The chief duty performed by their higher faculties is, not to afford predominant sources of enjoyment, but to communicate so much intelligence and honesty as to enable them to execute their labours skilfully and with fidelity. I speak of the great body of the labouring population; there are many individual exceptions who possess higher attainments; and I mean no disrespect even to this most deserving portion of society; on the contrary, I represent their condition in what appears to me to be a true light, only with a view to excite them to amend it.

The necessity of labour to the enjoyment of life, is imprinted in strong characters on the structure of man. The osseous, muscular, and nervous systems of the body, all require exercise as a condition of health; while the digestive and sanguiferous apparatus rapidly fall into disorder, if due exertion be neglected. Exercise of the body is labour; and labour, directed to a useful purpose, is as beneficial to the corporeal organs, and far more pleasing to the mind, than when undertaken for no end but the preservation of health. Commerce is rendered advantageous, because different climates yield different productions. Agriculture, manufactures, and commerce, therefore, are adapted to man's nature. Labour is beneficial to the whole human economy, and it is a mere delusion to regard it as in itself an evil; but the great principle is, that it must be moderate both in severity and duration, in order that men may enjoy, and not be oppressed by it. It may be objected, that a healthy and vigorous man is not oppressed by ten or twelve hours' labour a-day; and I grant that, if he be well fed, his physical strength may not be so much exhausted by this exertion as to cause him pain. But this is regarding him merely as a working animal. My proposition is, that after ten or twelve hours of muscular exertion a-day, continued for six days in the week, the labourer is not in a fit condition for that active exercise of his moral and intellectual faculties, which alone constitute him a rational being. The exercise of these powers depends on the condition of the brain and nervous system; and these are exhausted and deafened by too much muscular exertion. The fox-hunter and ploughman fall asleep when they sit within doors, and attempt to read or think. The truth of this proposition is demonstrable on physiological principles, and is supported by general experience. The first change, therefore, must be to limit the hours of labour, and to dedicate a portion of time daily to the exercise of the mental faculties. So far from this limitation being unattainable, it appears to me, that the progress of arts, sciences, and society is rapidly forcing its adoption. Ordinary observers appear to conceive man's chief end to be to manufacture hardware, broad cloth, and cotton goods, for the use of the whole world, and to store up wealth. They forget that the same impulse which inspires the British with so much ardour in manufacturing, will, sooner or later, inspire other nations also; and that, if all Europe should follow our example, and employ sufficient machinery, and a large proportion of their population in our branches of industry, which they are fast doing, the four quarters of the globe will at length be deluged with manufactured goods—only part of which will be required. When this state of things shall arrive—and in proportion as knowledge and civilization are diffused, it will approach—men will be compelled, by dire necessity, to abridge their toil, because excessive labour will not be remunerated. The admirable inventions, which are the boast and glory of civilized men, are believed by many persons to be at this moment adding to the misery and degradation of the people. Power-looms, steam-carriages, and steam-ships, it is asserted, have all hitherto operated directly in increasing the hours of exertion, and abridging the reward of the labourer. Can it be believed, that an almost creative power has been bestowed solely to increase the wretchedness of the many, and minister to the luxury of the few? Impossible. The destiny of society appears not yet to be divined. I hail them as the grand instruments of civilization, by giving leisure to the great mass of the people to cultivate and enjoy their moral and intellectual powers.

(*To be continued.*)

LATENT HEAT.

HEAT is of two kinds, sensible and latent. Sensible heat is that which affects the thermometer or touch; and latent heat is that which does not. Large quantities of heat must enter into bodies and become latent, in order to enable them to pass from the solid to the fluid state, and from the

fluid to that of vapour. Thus, the quantity of heat necessary to convert any given quantity of ice into water, would raise the same weight of water to 140° Fahr.; but we find that the temperature of the water thus converted, does not increase until the whole of the ice is dissolved; therefore this heat must be concealed, kept hid, as it were, or, to use the proper term, latent; as it cannot be detected by the sense of touch, or by application of the thermometer.

According to Dr. Black, the latent heat of steam, at the boiling point, is 810°, but more correct experiments prove it to be 1000°; but it is inversely proportioned to the degree of pressure under which it is formed; that is, the latent heat is greatest where the pressure is least, and least where the pressure is greatest; and the sensible heat and latent heat added together, give the sum of the sensible heat and latent heat at any other temperature. The latent heat at the boiling point is 1000°; sensible heat, $212° - 32 = 180 + 1000 = 1180$. This is the constant sum at any other temperature. Now steam, at the ordinary pressure of the locomotives, is from 40 lbs. to 60 lbs. upon the square inch; and, at that temperature, it will not scald close to the orifice of the valve, or within an inch or so (I have seen the experiment tried frequently by the engineers upon the railway); and, at the distance of three or four inches, we find it very hot, and the reason is this; the latent heat and sensible heat at this pressure are combined together in such proportions, that the latent heat destroys or overpowers the sensible heat; and the reason why it scalds at a short distance is, because the latent heat is set at liberty and flies off, and the sensible heat is left to exert its influence alone.

Whether it would scald at 80 lbs. or 100 lbs. upon the square inch or not, I cannot tell; but I think it would, as the sensible would be much increased, and the latent heat decreased.

BROOKS.

THE ROYAL GEORGE.

(From a Correspondent.)

COLONEL PASLEY began his proceedings for the removal of the wreck of the *Royal George* on the 1st of this month, but up to this day nothing very remarkable was effected. Two guns, the rudder, and a considerable quantity of timber, were recovered; but as these were merely those fragments of last year's work, which the inclemency of the season prevented the engineers from picking up, no serious measures were deemed necessary till the 15th.

At eight o'clock in the morning, the red flags at Spithead announced that a great explosion was to be attempted, and at eleven o'clock, one of those huge cylinders, which have already been described, and filled with 2116 lbs. of gunpowder, was lowered to the bottom. One of Colonel Pasley's divers (George Hall), who has acquired great expertness in these operations, descended his rope ladder a little in advance of the cylinder, and succeeded in fixing it securely to one of the lower gudgeons or braces on the rudder-post, within six or eight feet of the keel. The diver having remounted, and the vessels being withdrawn to a safe distance, the enormous charge was ignited by means of the voltaic apparatus. Within less than two seconds after the shock was felt, the sea rose over the spot to the height of about fifteen feet, or not quite half so high as it did on occasion of the great explosions last year, a difference ascribable, propably, to the cylinder on the present occasion having been placed under the hull, instead of alongside it. The commotion in the water, however, was so great, as to cause the lumps and lighters to pitch and roll at a great rate. The whole surface of the sea, for several hundred yards round, was presently covered with dead fish and small fragments of the cylinder. Amongst these, were innumerable tallow candles, and a mass of butter a foot and a half in length, evidently driven up from the purser's store-room.

As soon as the vast commotion in the water had subsided, and the boats had returned from the universal scramble for the candles and dead fish; the diver proceeded again to the bottom, and soon reported that the whole stern of the ship had been driven to pieces, and that, so far as he could ascertain, there was now a free and wide channel directly fore and aft the ship, from stem to stern, through which both the flood and ebb tides will rush, and thus the mud with which the hull of the *Royal George* has been silted for half-a-century will be washed out, and the way cleared for Colonel Pasley's farther operations. From the auspicious manner, indeed, in which he has commenced, we may safely predict his final success; and we confidently trust that, before the season closes, Spithead will be cleared of this grievous and long-standing drawback to its efficiency as a roadstead for line-of-battle ships.

LONDON JOURNEYMEN'S TRADES' HALL.

(REPORT.)

THE Provisional Committee deem it a duty they owe this Meeting, although an adjournment of the one held in this place on the 9th of March, to report to you the progress which has been made since they last had the pleasure of meeting the trades and operatives of London on this important subject.

The project for erecting a Trades' Hall by the united energies and subscription of the working men of the metropolis, is an Herculean office; and time and untiring perseverance in agitating the mass of mechanics will alone insure the prospect of success. Your Committee are proud to witness the activity and enthusiasm which prevail among the shareholders; and they entertain in their own minds the most confident expectations of realizing all the benefit and advantages of your undertaking.

In the Report which your Committee submitted to you on the 9th of March last, the applications for shares up to that period, were stated to be about 400. The enthusiastic reception which the project of a Trades' Hall received on that occasion, at the hands of a very crowded assembly, gave every reason to calculate on an accession of strength to its number. Arrangements were accordingly made for giving the utmost facility for the reception of the additional applications for shares which might be made. Two members of your Committee have been in attendance at the Trades' Hall Office, 16, Old Bailey, every evening up to the present time. Nearly 200 collecting-books have been distributed to the secretaries of trade societies and lodges, as far as it was practicable to communicate with them throughout the metropolis, as also to several of the shareholders; and although your Committee have not been favoured with any return officially of the number of applications contained in the majority of those books, they have learnt indirectly, that many of them contain several names; and, under all the circumstances of the case, your Committee feel warranted in calculating on having received up to this evening, applications for upwards of 1000 shares.

It is a source of peculiar pleasure to your Committee, to be able to communicate to you the spirited manner in which a number of the shareholders have already guaranteed the purchase of several hundred additional shares, so soon as 7500 shares shall have been taken up in this undertaking. Such a measure of imparting confidence and stability to its progress, it is anticipated, will receive the cordial support of the majority, if not all of the candidates for the Council, as it has already done that of your Committee. The success of a Trades' Hall is now in your hands; secure it to yourselves and your children, by an instantaneous and universal combination in its favour, and think that your duty remains undone, until you meet in the majesty of your thousands beneath its roof.

Your Committee have it in contemplation to recommend the adoption of some very energetic and immediate means to draw the attention of the London trades to the necessity of giving a decided support to the erection of a Central Trades' Hall, by investing a portion of their funds in the purchase of shares in this undertaking. Whether such means shall embrace district public meetings, or deputations, the Council, who are shortly to be elected, will be called upon to determine and carry out; in the meantime, every shareholder belonging to a trade society, is earnestly intreated to agitate this point immediately and constantly at their various meetings; and your Committee are not without an ardent hope, that in time your untiring exertions in its behalf in your respective trades, lodges, and workshops, will draw forth those large and important bodies of men to identify the moral and social welfare of their members with the speedy erection of a Trades' Hall.

It is highly encouraging to hear, that some of the trades are agitating the propriety of deserting the public house as inimical to the good conduct of their meetings, and prejudicial to the character of their members. An approximation so close to the real and fundamental objects of a Trades' Hall, will animate your Committee with the speedy prospect of the united support of such trades in securing the establishment of a building, where all may meet without reference to political or sectarian prejudices; and where the general convenience of the accommodation will produce a consolidation of the numerous lodges into which some are now divided, and produce a better and more unanimous administration of business.

Your Committee rejoice to learn, that the attention of the numerous lodges of the Friendly Society of Operative Carpenters has been seriously directed to the question of taking shares from their general fund; and it is a source of much gratification to your Committee to report, that so large and intelligent a body of men

have resolved on taking fifty shares in the undertaking now before you; in addition to which, the members of the Penny Fund connected with Lodge No. 13 of the same body, have also taken five shares. There is reason to augur, from this accession of collective strength, a great influx of energy and zeal in its behalf, which cannot be exercised in vain, when honestly directed to the welfare of the thousands who toil.

Your Committee have some reason to think, that the necessity and value of a Trades' Hall is forcing itself on the attention of a large and enthusiastic body of individuals, the advocates of total abstinence in London, who are pledged to the suppression of intemperance: a Trades' Hall aims at the same noble object, and a friendly understanding ought to exist between those who are identified in one common good: let that good, however, concentrate itself under the roof of a Trades' Hall, as the focus from whence the general promulgation of temperance shall spread far and wide among the labouring population of the country; for only in proportion as drunkenness, vice, and ignorance, are removed, will the moral and political character of the operatives be regenerated, and their welfare based on the permanent foundation of knowing and carefully preserving their position in society.

It is pleasing to find amidst the slow, but sure progress of this project, a gradual wish prevailing, in certain publications, to aid its promotion; these are mementos of the onward march of the principle of a moral and intellectual union of the working class; and your Committee, fully reconciled to the necessity of time and perseverance to consummate their anxious desires for the erection of a Trades' Hall, can look back on the past with feelings of satisfaction, and to the future with strong hopeful anticipations.

A few more days, and your Provisional Committee will no longer exist; they have gladly embraced the power vested in them by the 50th Law of Enrolment; and have accordingly convened a meeting of the shareholders to be held on Tuesday evening, the 26th of May, in the Aldersgate Street Temperance Chapel, for the purpose of proceeding to the popular election of a Council of Forty-five, and a General Secretary. And they deem it their duty, in taking leave of this meeting, to draw your attention to the list of candidates, who have been respectively proposed by shareholders for those offices in the following order.

Candidates for Council.

[Here follows a list of fifty-six candidates, chiefly working men.]

Your Committee have only to exhort their brother shareholders at the approaching election, to return such representatives as will "well and truly serve" the operatives of London, and the best interests of the Trades' Hall; let them be practical men—working men! who will rally round it as the day-star of your promised greatness; furnish them early with the means of erecting such a structure, and beneath its roof you will be able to demonstrate to the world the happy union of the intellectual, the social, and the political. Your Trades' Hall will be the great national school of the day, where operatives and their children shall be taught the best of all knowledge—the use and power of their intellects, the claims of citizenship, the extent and justice of their natural rights, and the duty of all to hold fast, and exercise such rights as are at present enjoyed, and to seek the immediate and legal restitution of all others, which may be still withheld from the industry of the empire.

[The following resolutions were unanimously agreed to; and though we differ from some of the speakers with regard to the best mode of improving the condition of *productives*, we were delighted to observe, that perfect order and good feeling prevailed throughout the evening, although the hall of the Institution was literally crammed.]

1. That it is the opinion of this meeting, that the working men of London, from their number, and the direct and indirect influence of their labour on the welfare of the country, ought to enjoy the utmost facility for assembling together on all matters of national and local importance; in order that the exercise of public opinion may be honestly preserved and freely used among them, as the wholesome safeguard of the rights of labour, and the general benefit of the empire.

2. That a Trades' Hall, in the centre of London, ought to supply a deficiency which is painfully felt to exist in the metropolis—an institution open to all classes, but more especially the operatives, without reference to political or sectarian prejudices, and in which public meetings of all kinds, and at all times, may be held at a very trifling cost.

3. That it is the opinion of this meeting, that the erection of a London Journeymen's Trades' Hall in a central situation, would at once present to the united trades of London the means of concentration, and promoting an easy and prompt com-

munication between them; while political associations, temperance and benefit societies, and all the various institutions which now abound, would, by meeting in such a building, give a moral, respectable, and commanding tone to their proceedings, and indicate the progress of intellect and influence among the working class.

4. That this meeting learns with delight, that some of the trades of London have already identified themselves with the principle of a Trades' Hall; and while it confidently relies on their support in carrying out the great objects of this undertaking, desires to appeal to the whole of the metropolitan trades, to consummate at once the success of the project, by immediately investing a portion of their respective funds in the purchase of shares.

5th Resolution proposed by individuals spontaneously in the meeting.

Thanks to Provisional Committee for their persevering exertions in forwarding the undertaking.

THE CHEMIST.

ON ALKALIES.

(Continued from page 14.)

Digitalia (Vegeto).—To obtain this alkali, M. Leroyer takes one livre of fox-glove, and treats it first with cold ether, and then with the same fluid heated in a close stove, in order that the temperature may be raised to a considerable degree. The tinctures obtained in this manner are (after being mixed and filtered) of a greenish-yellow colour; the residue, from their evaporation, being taken up by water, divides into two parts; one remains in solution, and the other is precipitated. Hydrate of protoxide of lead is then added to neutralise some free acid, which the solution contains. The portion thus treated with lead, is to be evaporated to dryness, and then dissolved in highly rectified ether; by which process the bitter principle of the fox-glove is obtained, disengaged from those matters with which it was contaminated. By evaporation, the solution yields a heavy brown substance, which restores very slowly the blue of reddened turnsol paper. This character, as well as its bitterness, approaches it to the alkalies, though its extreme deliquescence separates from them.

Emetina (Vegeto).—M. Collandor's process for obtaining pure emetina is as follows:—Mix about four ounces of the cutical part of ipecacuanha in powder, with about twenty-five ounces of water, acidulated with fifteen grains of sulphuric acid; boil the mixture, and then keep it a little below that point of heat for half-an-hour, stirring it constantly with a wooden spatula; then pour the whole into an earthen dish, presenting as great a surface as possible. This acidulated decoction is left to cool, and four ounces of lime in powder is then added; the whole is then dried in a stove at a temperature not exceeding 145° Fahr. This mass, which is composed of sulphate and gallate of lime, fatty and colouring matter, combined with an excess of lime, free emetina, fecula, and ligneous matter, is then pulverized; on submitting it to the action of alcohol, the emetina is dissolved, from which it may be obtained by evaporation. Pure emetina is white, and is not changed by the atmosphere. It is slightly soluble in cold water, more so in hot, very much so in ether and alcohol. It is very fusible, melting at 122° Fahr. It dissolves in all acids, diminishing, without extinguishing their acid properties; at the same time it forms with them salts that are readily crystallizable. According to the analysis of MM. Dumas and Pelletier, it is composed of

Carbon	64.37
Azote	4.00
Hydrogen	7.77
Oxygen	22.95
	99.09

Hyoscyamia (Vegeto).—This alkali was discovered by Brandes in the seeds of the black henbane; the tincture of which is to be mixed with a small quantity of lime, and the precipitate digested in dilute sulphuric acid. The solution containing sulphate of hyoscyamia is then decomposed by carbonate of soda; the precipitated hyoscyamia is then removed from the solution, and dried on blotting-paper. It is then dissolved in absolute alcohol, filtered through animal charcoal, and the solution evaporated, which yields it pure. Hyoscyamia is very poisonous, and of a bitter taste. It forms silky crystals, which are almost insoluble in water, but soluble in alcohol and ether. It is decomposed when heated with the fixed alkalies, and evolves ammonia.

Septimus Piesse.

MISCELLANEA.

The Skin of a Boa has been presented to the Museum of the Asiatic Society of Bengal, which measured twenty feet in length. When shot, the boa measured twenty-one feet. " It had swallowed a spotted deer, which was taken out of the inside, not too much decomposed for the spots in

the skin to be quite distinct. Where the deer was, the skin measured three feet, one inch across."

Feather Flowers.—At the exhibition of the Horticultural Society, last week, much interest was awakened by the beauty and truth of an imitation of a rose, constructed entirely of feathers, of their natural colour and shape, the work of Mrs. Randolph, of Bridge Street, Westminster, a self-taught proficient of her very beautiful art. A great variety of "flowers of all hue," manufactured, if we may use the word, by this lady, were exhibited at the last *soiree* of the Marquis of Northampton, and were much and generally admired.—*Athenæum.*

The Vial of Four Elements.—Take a vial six or seven inches long, and about three-quarters of an inch in diameter; in this vial put first, glass coarsely powdered; secondly, oil of tartar; thirdly, tincture of salt of tartar; and, lastly, distilled rock oil. The glass and the various liquors being of different densities, if you shake the vial, and then let it rest a few moments, the three liquors will entirely separate, and each assume its place; thus forming no indifferent resemblance of the four elements.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, May 27, D. Ziliani, Esq., on the Italian Literature of the 16th Century. Friday, May 29, G. H. Pell, Esq., on Fluctuations in the Quantity, and, consequently, in the Value of the Currency; on the Causes and Effects of such Fluctuations, and on the Means of Prevention. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, May 28, N. F. Zaba, Esq., on the Moral and Intellectual Powers of Woman, and the Influence she has exercised on the progress of Civilization in Europe and Asia. At half-past eight.

Poplar Institution, East India Road.—Tuesday, May 26, J. H. Elliott, Esq., on Physical Education. At eight o'clock precisely.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch—Wednesday, May 27, a Lecture on Astronomy. At eight o'clock.

QUERIES.

Whether the metal heads for weaving woollen, linen, and cotton fabrics, for which a patent was taken out a few years since, are answering, or in use? W. B.

How Manning's wooden houses for emigrants are constructed? I mean such a description as would enable a mechanic to construct one on the same principle.

BENJAMIN TONGUE.

ANSWERS TO QUERIES.

To make the best Blacking.—Take of ivory black, four ounces; coarse brown sugar, three ounces; sweet oil, a table-spoonful. Mix them gradually in a pint of cold small beer.

A good Tooth Powder.—Prepared chalk in powder, four ounces; powdered cuttle fish, two ounces; powdered orris root, two ounces. Mix.

Tincture for the Toothache.—Take of pellitory of Spain, two ounces (it is called "radix pyrethri" by druggists); spirits of wine, half-a-pint; water, half-a-pint. Steep the pellitory in the spirit and water for fourteen days, and then strain.

To make Pilul. Rhei. Comp.—Take of powdered rhubarb, one ounce; powdered aloes (socotrina), six drachms; powdered myrrh, four drachms; powdered Castile soap, one drachm; oil of carraway, half-a-drachm. Mix the powders together first, then add the oil, and beat it all up with treacle and water to the consistence of putty.

A. C. R.

TO CORRESPONDENTS.

Sigma *can obtain the back Numbers he wants at the publisher's.*

G. D. L.—*The first step in the study of mechanical science, is geometry. Simson's edition of* Euclid *we recommend as the best; but cheaper works, that would answer the purpose of a beginner, may be met with at second-hand shops. This is a very easy study, and scarcely requires any other teachers than books. After this, a little algebra will be required; and, as the student proceeds, his own wants will point out the different subjects it is necessary for him to study.*

J. Rothwell *wishes to know "Upon what principles the hydrometer and barometer are constructed? What causes the mercury to rise or fall in the barometer? Also, what causes the rising of the hydrometer in strong, or its sinking in weak liquid?" The mercury rises and falls in the barometer, because the pressure of the air varies; sometimes forcing up, and sustaining a column of thirty inches, and, at others, sustaining only twenty-eight inches. If a barometer be placed under the receiver of an air-pump, the mercury will fall as the air is exhausted; and if a perfect vacuum could be obtained, the mercury in the tube would subside to the level of that in the reservoir. The hydrometer does not rise in strong spirit; spirit is lighter than water, therefore the instrument sinks lower, the upward pressure of the liquid being less. This instrument indicates the specific gravity of the fluid in which it is immersed, and hence is inferred the proportions of water and spirit contained in a compound.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

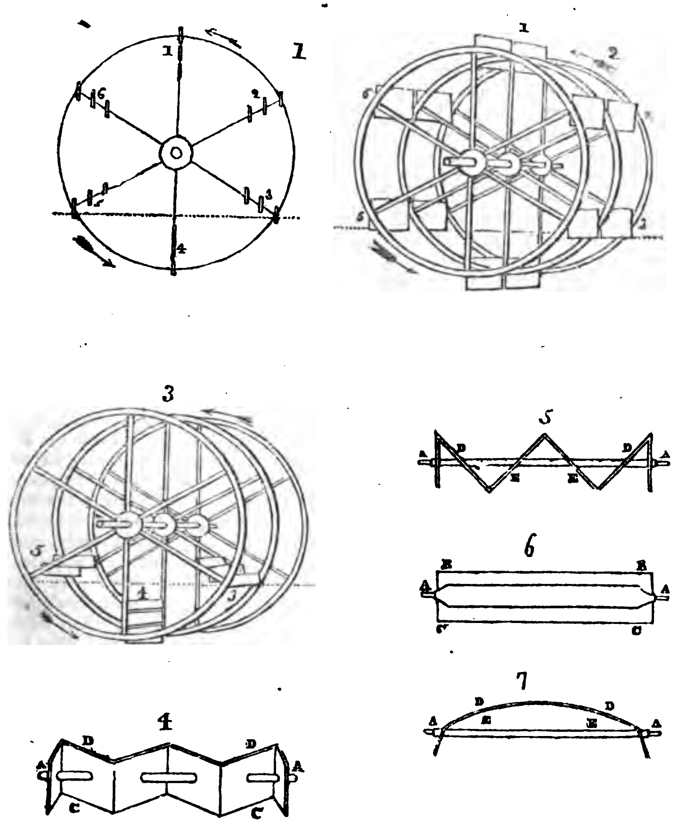
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 94, NEW SERIES. | SATURDAY, MAY 30, 1840. PRICE ONE PENNY. | No. 215, OLD SERIES.

TODD'S PATENT PADDLE-WHEEL.



City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

TODD'S PATENT PADDLE-WHEEL.

(See Engraving, front page.)

Although experience has shown, that the ordinary fixed paddle is more effective and convenient, in every respect, than the thousand and one whimsical contrivances which have been proposed to supersede it, still it should not be forgotten, that the fixed paddle is not free from defect; therefore, attempts at improvement should not be abandoned as hopeless. Mr. Todd's invention is ingenious, and may lead to something useful; but, in its present state, we do not expect, indeed we are convinced it will not stand the test of trial. The following description is an abstract of the specification:—

"*Description of the Engraving.*

Fig. 1 is a vertical section, on a small scale, across the paddle-wheel shaft of a steam-vessel, and shows the constant vertical position of my improved paddles during the revolution of the paddle-wheel. The paddles, No. 5, are just entering the water, No. 4, at their deepest immersion, and No. 3, just leaving the water. The paddles in this figure are represented as plain three-fold paddles (see fig. 3).

Fig. 2 is a perspective view of a three-rimmed paddle-wheel, and shows the constant vertical position of single paddles, as placed in both divisions of the wheel during its revolution.

Fig. 3 is another perspective view of a three-rimmed paddle-wheel, similar to fig. 2, showing the manner of placing any number of paddles on the arms or spokes and rims of the wheels at present in use; but the number of such places will, of course, depend on the number of arms or spokes in the wheel, and other circumstances. Only three sets of the three-fold paddles, in one division of the wheel, are shown in this figure. N.B. The paddles in these three figures (1, 2, and 3), are to be considered as my improved paddles (see figs. 4 and 7) being represented only plain, to prevent confusion in the drawing. Only six places for paddles are represented for the same reason. The arrows show the direction of the wheel.

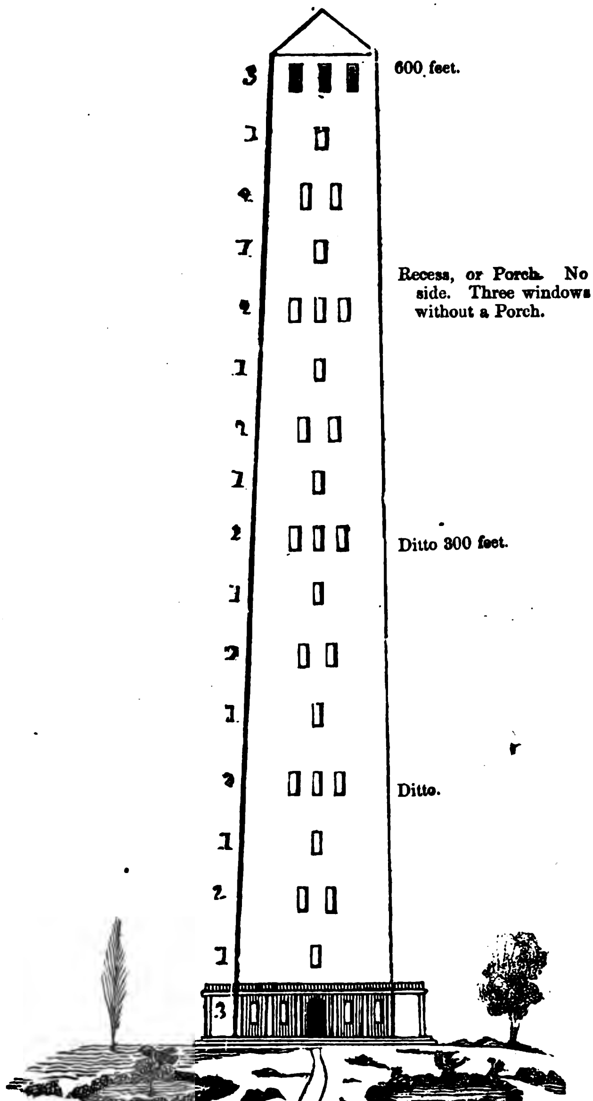
Fig. 4 is a front view of one form or shape of my improved paddle. It is formed into zig-zags or angles, as in the figure, on a large scale, or into a curved-shaped (see fig. 7). A A is an axle passing through the centre of the paddle lengthwise, and securely fixed thereto. The gudgeons, A A, at each end of the paddle, are turned and move in brasses, which are fixed securely to the arms or spokes and rims of the common paddle-wheels at present in use. By the arrangement, very few alterations will be necessary in adopting my improvements. B B shows the top or upper side of the paddles; and C C, the bottom or lower side of the same. The side, C C, is weighted, so as to keep those paddles not immersed in the water, during the revolution of the wheel, in a vertical position.

Fig. 5 is a bird's-eye view, and shows the top or upper edge, B B (see fig. 4). The side, E E, is the head stroke, propelling the vessel forward, and the side, D D, shows the back stroke propelling the vessel astern.

Fig. 6 is a front view of a plain paddle.

Fig. 7 is a bird's-eye view of another form or shape of my improved paddle on a large scale. The same letters refer to the same parts, as in fig. 5. It will be seen, on a careful examination of the drawings and descriptions, that my improved paddles are self-adjusting, and do not require the mechanical aid of any stops, crank, levers, rods, grooves, eccentric wheels, pinions, chains, or any other kind of machinery, and that all extra friction is hereby avoided; also the tail or back-water. This is not the case with the common paddles at present in use, the said back-water being universally acknowledged to be a very great drawback on the effective power of the engine. My improved paddles, by entering the water vertically, or very nearly so, will not occasion the tremulous motion, common to steam-vessels, at present so injurious to them, and so much complained of by passengers; and, by leaving the water in the same vertical position, the swell of the back-water is avoided, and, consequently, the great danger to boats, &c., on approaching a steam-vessel under way. My improved paddles begin their horizontal propelling action at the instant of their immersion, and continue the same until they leave the water; this is not the case with the common paddles. With my improved paddles, it matters not how deeply the vessel is loaded; but, with the common paddles, the deeper the vessel, and the greater is the weight of back-water to be raised, occasioning danger to the machinery and loss of speed. My improved paddles can be readily fixed to the wheels at present in use."

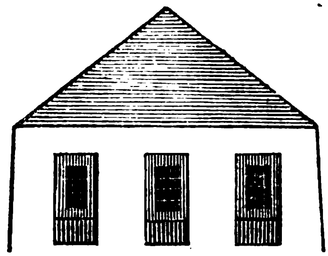
DESIGN FOR A GRAND NATIONAL OBELISK.



SOUTH FRONT VIEW.

The south front of the highest apartment, to be within the outer walls a distance of about ten or twelve feet, so as to form a porch, with an iron rail to each of the window-like spaces, or intercolumniations; a comparatively small window at the east and west ends of the porch. The north side of the room to receive light from three windows, of five feet wide and nine in depth. The east and west to have

two each. Total height from the level of the ground to apex, 650 feet; diameter at base, 100; height of floor of upper apartment, 600 feet; diameter, 63. One and two windows, alternately, on the east and west faces, except the upper and basement apartment. The following represents the upper apartment, on a scale of



a quarter of an inch to ten feet. No projection, so that every possible view of the obelisk presents one simple outline. The interior of upper apartment to be highly embellished.

J. B.

ON THE EDUCATION OF THE WORKING CLASSES.

(Concluded from page 27.)

One requisite to enable man to follow pursuits referrible to his higher endowments is, provision for the wants of his animal nature; that is, food, raiment, and comfortable lodging. It is clear that muscular power, intellect, and mechanical skill, have been conferred on him with the design that he should build houses, plough fields, and fabricate commodities; but, assuredly, we have no warrant for believing, that any portion of the people are bound to dedicate their whole lives and energies, aided by all mechanical discoveries, to these ends, as their proper business, to the neglect of the study of the works of the Creator. Has man been permitted to discover the steam-engine, and apply it in propelling ships on the ocean and carriages on railways, on spinning, weaving, and forging iron; and has he been gifted with intellect to discover the astonishing powers of physical agents, such as revealed by chemistry and mechanics—only that he may be enabled to build more houses, weave more cloth, and forge more iron, without any direct regard to his moral and intellectual improvement? If an individual, unaided by animal or mechanical power, had wished to travel from Manchester to Liverpool, a distance of thirty miles, he would have required to devote ten or twelve hours of time, and considerable muscular energy to the task. When roads and carriages were constructed, and horses trained, he could, by their assistance, have accomplished the journey in four hours with little fatigue; and now, when railways and steam engines have been successfully completed, he may travel that distance, without any bodily fatigue whatever, in an hour and a half. And, I ask, for what purpose have the nine hours been bestowed, which are thus set free to the individual? I humbly answer, for the purpose of cultivating his rational nature. Again, by the application of the steam engine to spinning and weaving, much time and labour has been saved. For what purpose, I repeat, has this time been set free? Every discovery in natural science, and invention in mechanics, has a direct tendency to increase the leisure of man, and to enable him to provide for his physical wants with less laborious exertion.

In proportion as mechanical inventions shall be generally diffused over the world, they will increase the powers of production to such an extent, as to supply, by moderate labour, every want of man, and then the great body of the people will find themselves in possession of reasonable leisure in spite of every exertion to avoid it. Great misery will probably be suffered in persevering in the present course of action, before their eyes shall be opened to this result. The first effect of these stupendous mechanical inventions threatens to be, to accumulate great wealth in the hands of a few, without proportionably abridging the toil, or adding greatly to the comforts of the many. This process of elevating a part of the community to affluence and power, and degrading the rest, threatens to proceed till the disparity of condition shall have become intolerable to both, the labourer being utterly oppressed, and the higher classes harassed by insecurity. Then, probably, the idea may occur, that the real benefit of physical discovery is to give leisure to the mass of the people, and that leisure for mental improvement is the first condition of true civilization—knowledge being the second. The science of human nature will enable men at length to profit by exemption from excessive toil; and it may be hoped that, in course of time, the notion of man being really a rational creature, may meet with general countenance, and that sincere attempts may be made to render all ranks prosperous and happy, by institutions founded on the basis of the superior faculties.

Man appears to be destined to advance only by stages to the highest condition of his moral and intellectual nature; and he is yet only in the beginning of his career. Although a knowledge of external nature and of himself is indispensable to his advancement to his true station, yet 400 years have not elapsed since the arts of printing and engraving were invented, without which, knowledge could not be disseminated through the mass of mankind; and, up to the present hour, the art of reading is by no means general over the world; so that, even now, the *means* of calling man's rational nature into activity, although discovered, are but very imperfectly applied. It is only five or six centuries since the mariner's compass was discovered in Europe, without which, even philosophers could not ascertain the most common facts regarding the size, form, and productions of the earth. It is only 340 years since one-half of the habitable globe, America, became known to the other half. It is little more than 200 years since the true theory of the circulation of the blood was discovered, previously to which, it was impossible even for physicians to form any correct idea of the uses of many of man's corporeal organs, and of their relations to external nature. It is only between forty and fifty years since the true functions of the brain and nervous system were discovered, before which, we possessed no adequate means of becoming acquainted with our mental constitutions, and its adaptation to external circumstances and beings. It is only fifty-seven years since the study of chemistry, or of the physical elements of the globe, were put into a philosophical condition by Dr. Priestley's discovery of oxygen; and hydrogen was discovered so lately as 1766, or seventy-four yeas ago. Before that time, people in general were comparatively ignorant of the qualities and relations of the most important material agents with which they were surrounded. At present, this knowledge is still in its infancy, as will appear from an enumeration of the dates of several other important discoveries. Electricity was discovered in 1728; galvanism, in 1794; gas-light, in 1798, and steam-boats, steam-looms, and the safety-lamp, in our own day. It is only of late years that the science of geology has been seriously begun. An inconceivable extent of territory remains to be explored. The mechanical sciences are at this moment in full play, putting forth vigorous shoots, and giving the strongest indications of youth, and none of decay. In consequence of this profound ignorance, man, in all ages, has been directed in his pursuits by the mere impulse of his strongest propensities, formerly to war and conquest, and now to accumulating wealth. Up to the present day, the mass of the people in every nation have remained entirely ignorant, the tools of interested leaders, or the creatures of their own blind impulses, unfavourably situated for the development of their rational nature. Finally, the arts and sciences seem to be tending towards abridging human labour, so as to force leisure on the mass of the people; while the elements of useful knowledge are so rapidly increasing, the capacity of the operatives for instruction is so generally recognised, and the means of communicating it are so powerful and abundant, that a new era may fairly be considered as having commenced; and whenever the great majority of the working classes shall have acquired a sense of the true dignity of their nature, and a relish for the enjoyments afforded by their higher capacities, they will become capable of so regulating the supply of labour in reference to the demand, as to obtain the means of subsistence in return for moderate exertion. I see the slow progress of the human race in the past, and do not anticipate miracles for the future. If a sound principle is developed—one having its roots in nature—there is a certainty that it will wax strong, and bear fruit in due season; but that season, from the character of the plant, is a distant one. All who aim at benefiting mankind, ought to keep this truth constantly in view. Almost every scheme is judged of by its effects on the living generation; whereas no great fountain of happiness ever flowed clear at first, or yielded its full sweets to the generation who discovered it.

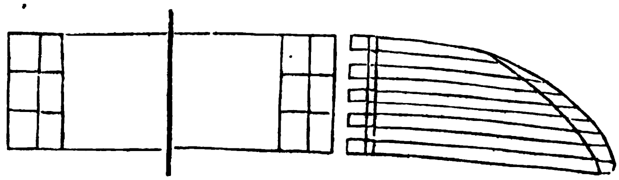
WALTER'S PADDLE-WHEEL.

The resistance with which the paddle meets in coming out of the water, is chiefly owing to the paddles being entirely flat, which, if they are so constructed as to cause them to incline a little, which I have found by repeated experiments; in any way there is an approximation towards the object wished for. It will be seen, that, in the present plan, the paddle is divided into six divisions, one under the other; in which one part or end of the paddle rises out of the water before the other end, allowing the water to escape in smaller portions. Being made like steps, it does not carry with it one continuous volume of water. I hope this attempt

will induce some one to make a model of it. The drawing, representing the frame behind the wheel, which may be omitted, is to check the spray of the water, and placed about a foot above the water's edge.

S. WALTER.

May 23, 1840.



LIFE ASSURANCE.

NO. V.

SYSTEMS.

It is now our desire to place before the reader some brief observations on the various systems which Life Assurance Societies adopt, with the hope that every discreet person will think for himself before embracing any of them; but we would qualify this advice by adding "Embrace one of them." It will not be our duty to point directly to those possessing superior advantages at present, nor even give those which we deem the most favourable a precedence in our statement, but confine ourselves merely to remarks.

The Proprietory, or Joint-stock system, stands first in our notice, from the fact of such societies having been established for the noble purpose of assuring the lives of persons in the event of premature death, for more than a century. These societies have one uniform method of raising what they term a capital, stated in their prospectuses to be half-a-million, or a million pounds sterling, and, in some cases, more. This sum has been mentioned merely nominally, there being generally but some ten to fifteen thousand pounds raised in this manner, amongst a number of persons called shareholders. It can be readily supposed by the reader, we presume, that a large borrowed capital cannot be of much use, but at the commencement of a society; and even then, 10,000*l*. would be a considerable sum to keep yearly, or half-yearly interest paid upon; and, let us remark, this interest must come from the premiums which the assurers have paid the Society.

It will be observed, then, that these shareholders are strictly speaking, the sole proprietors of such a Society; no assurer whatever, having any right, as an assurer, to ask any question about the Society, or meddle with its management; but to pay his or her premium, and leave the sum assured to be paid at death, without any profits.

There is no doubt that such Societies have hitherto realized immense gains; but the divisions of their profits have been wholly made among themselves.

The next mode of assurance, set up as a system, is called the *Mixed Proprietary*, or a Society with a raised capital in shares, amongst numerous shareholders, who, after dividing a certain portion of all their gains every three or five years, amongst such shareholders, give the remaining portion, generally very small, to their assurers. But perhaps, in some measure, an assurer in one of these Societies, is not in so favourable a position as in one where he was not led to expect profits, which, ultimately, are the mere shell of the oyster; that is to say, under the expectation of such profits as have been described as four sixths (why not say two-thirds?), three-fifths, two-fifths, &c., assurers are obliged to pay something considerably more per annum, by way of premium, and yet are with a Society, the internal affairs of which they are not to know anything of, nor whether, at last, they do receive their just proportion of profit or not. For, be it observed, such a Society, having a borrowed capital, must confine its secrecies of management to the proprietors or shareholders only, to whose interest it is to keep up a borrowed capital; or, at some meeting of the assurers, a voice would be raised to discharge the further use of such a capital, it having been found to be nothing better than a burden on the Society's funds; and then the joint-stock gentleman's interests would be at an end! Such a course was followed fifteen months ago by one of the Societies we have named, and they are now free from nominal funds no longer needed.

Another thing appears on the face of both the systems alluded to, which is worthy the reader's attention. The Societies who have raised a large capital, as has

been described, although every one must know they could not afford to pay the interest upon a tenth part of what they state to be their capital "in print;" yet they make use of this statement to assert further, that every assurer in such a Society has no responsibility resting on him, in consequence of their immense capital; but of this, the public can be no more aware, than they can be whether such a Society really possesses any of the capital that has been mentioned, or not; for no assurer, as we have said before, is permitted to examine the Society's books and see. For aught he might know, in such a Society's Deed of Settlement, some liability might be linked to every assurer; but to him the Society says with the poet,

"Where ignorance is bliss, 'twere folly to be wise."

It may be further stated, that some of the Societies we have just been glancing at, are connected with Fire Insurance, and of many years standing; so that, in such a case, their respectability cannot be for one moment doubted, notwithstanding all we have said respecting their system; but, it is to be hoped, they soon will yield their profits to the assurers upon a reasonable scale of assurance, and (never mind what becomes of their borrowed capital), strictly confine themselves to the funds accumulated by the premiums. True, that such a Society, acting upon this principle, would no longer be deemed private property, and each assurer would become a member; but then the evils, which are now found in some of the newly-started Joint-stock Societies, would be prevented; for now, if public ideas were not led astray by our great Proprietary Companies, would fresh Societies gain confidence, whose only aim appears to be, a speculation on the purse of the million, and, as many as can be caught, will be caught! It is well known by experienced accountants, that if many of the recently-formed Societies with capital, had been upon a principle of mutual benefit to assurers, with a scale of prices not too low,* as we have before remarked, some thousands could be spared the anxieties they now feel, who have invested their little all in them. Some important cautions were put forth in *Chambers' Journal* a few months back, which every man, who intends to assure, would do well to peruse; and he may make a further inquiry of some value to him, if he but takes notice of the character we have drawn of Joint-stock Societies, and views in a proper light, the security, or non-security, of their imaginary capital. But we will defer further advice until speaking of Mutual Societies, and only add, should the feeling of any prompt them to choose a proprietary system, merely for the sake of assuring a certain sum of money, the oldest established offices deserve their first attention, whose stability may be relied upon, whatever may appear in their tables that is objectionable, or to the public's disadvantage.

SIGMA.

* If the premiums were really too low, capital would still be an injury, and not a benefit; for, since this capital is really paid for, in whole or in part, out of the premiums, it would not preserve the office from insolvency, but would rather accelerate its progress towards bankruptcy.' —*De Morgan on Probabilities.*

THE GREAT WESTERN STEAMER.

THE progress of steam locomotion within the last quarter of a century, surpasses, beyond comparison, all other achievements of science on record. In 1814, the first steam-vessel within the United Kingdom was built. In 1820, there were only eight built, with a total tonnage of 655; in 1825, there were twenty-four built, tonnage 3003; in 1835, eighty-six, tonnage 10,924, and the number is still increasing at the present time. The passage of the Atlantic, by the unaided power of steam, was, till lately, considered a problem of doubtful solution. Every difficulty is, however, now triumphantly overcome. Since the spring of 1838, the *Sirius*, the *Royal William*, the *Great Western*, the *British Queen*, &c., have repeatedly accomplished the voyage with as much certainty and ease as the passage between London and Margate. The idea of constructing a steam-vessel of great magnitude to perform the voyage from London to New York, originated in a conversation between some gentlemen concerned in the Great Western Railway, while waiting the result of a discussion in a Committee of the House of Commons. "What a pity it is," said one, "that our territory is so limited; I wish we could carry a railway to America." This remark, though suggesting no means of accomplishing the object, led to serious reflections on the want of a speedier and more commodious conveyance than existed at that time between England and America; and before the next bottle was emptied, the construction of the *Great Western* steam-ship was decreed; and such has been the success of this bold and magnificent enterprise, that the attention of the French legislature has been directed to the subject; and last

week, a grant of 25,000,000 of francs, or about 1,000,000 pounds sterling was allowed by the Chamber of Deputies, for building steam-ships of great dimensions, that may compete with what they call "*Le Gra-art Vestairn et la Breteech Qua-arn.*"

The dimensions of the *Great Western* and her machinery are as follows :*—

	Ft.	In.
Length of vessel between the perpendiculars	212	0
Length of vessel over all	236	0
Depth of hold	23	3
Extreme breadth of beam	35	4
Width measured outside the paddle-cases	58	4
Draught of water when loaded	16	0
Burthen in tons—1340 tons		
Diameter of paddle-wheels	28	0
Height of centre of shafts	18	5
Diameters of shafts—15 and 16 inches.		
Width of bearings	1	3
Diameter of cylinders	6	1
Length of stroke	7	0
Diameter of air-pump	3	4
Length of stroke of ditto	3	6
Length from centre of shaft to centre of cylinder	19	6
Width from centre to centre of engines	13	0
Four boilers of equal dimensions with separate furnaces and flues — Length	11	6
Width	9	6
Height	16	9
Weight of engines—about 200 tons.		
Power of engines—450 horses.		
Weight of boilers—100 tons.		
Water in boilers—80 tons.		

Smoky Chimneys.—It has often occurred to us, that one very common cause of smoky chimneys, where no apparent reason can be discovered, arises from the practice of using boys to sweep them, and thus the sin against humanity is partly punished by a large amount of continuous annoyance. For a flue to draw well, it is essential that there should be only two openings into it; one at the bottom and the other at the top. Now chimney flues are divided from one another by single courses of bricks in width, or half bricks, as it is technically termed. Those flues are built with lime mortar, which is an absurdity in the outset, as the heat of the fire restores the mortar to the state of quicklime, which falls out in powder, and leaves gaping chinks for misdraught between the bricks, destroying the continuity of the flue. To provide, in some measure, against this evil, the practice is to coat the inside of the flue with a composition of lime mortar with cow-dung, called "pargetting." This is, in fact, a luting to make the flue air-tight. The climbing boys, by frequent ascents, break the luting away: and the chimney, opening into chinks, produces an imperfect draught. This is an evil for which there is no remedy, except rebuilding the chimney. Were it the practice to use iron tubes built into the thickness of the walls, or, better still, as more economical of heat, to introduce hollow iron columns upon the face of the wall, covering them in the apartments with perforated screen partitions, the great source of evil would cease, and the still greater evil, the crime, the degradation of humanity, would cease also. —*London and Westminster Review.*

* This description is extracted from a very instructive annual publication called "The Companion to the Almanac."

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, June 3, Quarterly General Meeting. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, June 4, N. F. Zaba, Esq., on the Moral and Intellectual Powers of Woman, and the Influence she has exercised on the progress of Civilization in Europe and Asia. At half-past eight.

Poplar Institution, East India Road.—Tuesday, Juna 2, B. R. Haydon, Esq., on Painting. At eight o'clock precisely.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch—Wednesday, June 3, a Lecture on Astronomy. At eight o'clock.

TO CORRESPONDENTS.

NOTICE.

Every purchaser of the Title, Preface, and Index to Vol. V., which accompanies the present Number, is entitled to an Engraving representing the Great Western Steam-ship.

Tyro Botanicus.—*The Stanhope lens may be seen at most opticians; we have seen them at Palmer's, Newgate Street, and Pizzala's, Charles Street, Hatton Garden. We should like him to write more fully upon the subject of his remarks. It is true that much fiction is mixed up with chemical science, and whoever shall succeed in separating speculative theories from real science, in such manner as, leaving philosophy in full enjoyment of all its vagaries, to establish a science that might be designated* ORTHOSOPHY, *describing things that* are, *and rejecting things that only* might be, *such as latent heat and light; and things that* might not be, *as the doctrine of atoms, &c. Whoever does this, will render a greater service to the cause of truth and science, than the most brilliant discoveries have done, when, as is frequently the case, they are combined with falsehoods.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

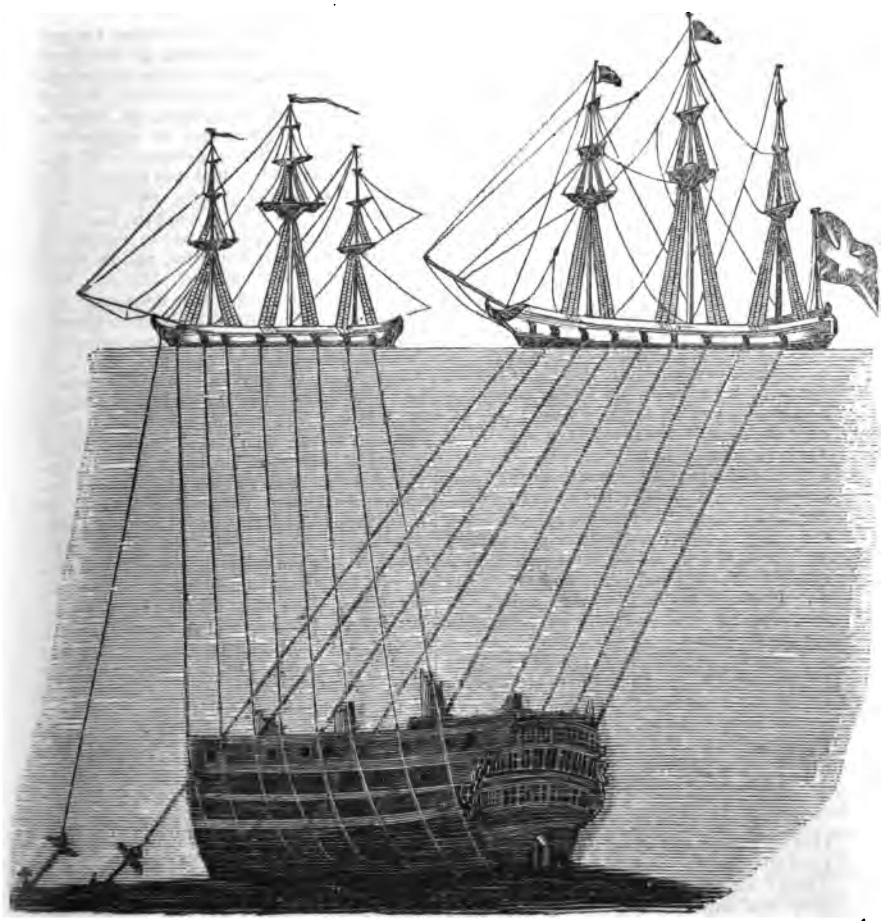
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 95, NEW SERIES. | SATURDAY, JUNE 6, 1840. PRICE ONE PENNY. | No. 216, OLD SERIES.

PLAN FOR RAISING THE ROYAL GEORGE.



 City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

THE ROYAL GEORGE.

To the Editor of the Mechanic and Chemist.

(See Engraving, front page.)

SIR,—The destruction of the wreck of the *Royal George* at Spithead, by means of Col. Pasley's apparatus, having of late so much engrossed the public attention, I beg to forward you a representation of an attempt which was made to raise her soon after her sinking; an attempt, however, which proved unsuccessful, in consequence of the huge cable by which she was partially raised, giving way.

I am, Sir,
Yours respectfully,
A CONSTANT READER OF THE MECHANIC AND CHEMIST.
Portsmouth.

NEW DISCOVERY IN PHOTOGRAPHY.

To the Editor of the Mechanic and Chemist.

SIR,—From some experiments I have lately made with the Daguerreotype, I have good reason to believe I have discovered a method of fixing the pictures on the surface of the metal, so that it cannot be removed without considerable friction; and this by a process so simple, that I only wonder it has not been found out before. I only wait to make a few more experiments, to remove all doubts of the efficacy of my method. Now my reason for addressing you is, to know how I can secure the benefits resulting from my discovery to myself, having no means of procuring a patent; and, when even it is procured, it is not an effectual security to the patentee; and, if I were to make known my process, either publicly or privately, I feel assured I should be infallibly robbed of all the honour and profit resulting from it. I see examples of this daily. In England there is certainly no protection for the poor man.

I am acquainted with one or two processes, which would be of great service to the arts, but fear to make them known for the same reasons. I would, however, willingly do so, if I were certain of securing in any way even a moderate reward.

I am, Sir, your obedient servant,
A. Z.

[Our correspondent is, doubtless, aware, that a patent has been obtained in this country, for the Daguerre process. The French legislature considered the discovery too important to be withheld from the public by any personal patent or privilege, and, accordingly, granted a pension of 10,000 francs, or 400*l.* per annum, to M. Daguerre and his collaborator, M. Niepce (240*l.* to the former, and 160*l.* to the latter), upon the condition that the whole of the process should be described for the unrestricted benefit of the public. This is legislating for the nation, and rewarding, and, consequently, eliciting talent. Compare this with the unjust, narrow-minded, anti-Mecænatian conduct of the British Government. The same law which inflicts a penalty of from 300*l.* to 600*l.* upon every person convicted of labouring successfully for the public good, by inventing anything new and useful, is brought to bear against the people of this country, and deprives them of all participation in the benefit which the French Government have purchased, not for their countrymen alone, but for the whole scientific world. The Daguerreotype, though wonderfully accurate in its result, has the disadvantage of involving an expensive, tedious, and difficult process. If the atrocious patent law had not filched this invention from the people, many of our ingenious artists might, ere this, have so simplified the process, as to render it available to every traveller, and to every admirer of nature and art. But no; Mr. Jack Noakes has otherwise ordained. He takes his bags of gold to Messrs. Quirk, Gammon, and Snap; those gentlemen fee Mr. Attorney-general; he fees Mr. Tom Styles, and at last the patent is sealed, and it is declared in the name of the highest authority in the land, that Mr. Jack Noakes is the only person in the United Kingdom worthy of profiting by M. Daguerre's invention; and a sort of legal excommunication is fulminated against all those who may presume to invade the purchased honours of the great Mr. Noakes. It must be observed, that this is not bartering the rights of the people for 300*l.*; it is only putting in force an Act of Parliament which decrees, that, under such circumstances, any person possessing money may, by paying certain fees, cause the rights of the whole nation to be suspended in his favour. We implore our contemporaries to assist us in exposing and holding up to universal execration a law which encourages an intriguing speculator, and inflicts an insupportable penalty upon merit.

If "A. Z." should succeed in simplifying the Daguerre process, so that the instrument would be conveniently portable, and the operation of easy execution, he will possess a secret of great value; but, in the present state of the English law which, instead of protecting, absolutely

persecutes merit), he is not likely to obtain any of those benefits to which he is, in justice, entitled; but it will not be our fault, if things are not in a fair way of improvement before the end of next session of Parliament. We advise our correspondent to continue his experiments, and communicate them to no one; recollecting that the desired object is not so much the extreme precision and minuteness of detail exhibited in the Daguerreotype, as a cheaper and easier process, which will give a view with sufficient distinctness to show the shape and proportions of the chief objects in the image, so that a tolerably accurate drawing might be made from it. Any communication addressed to us with the word "confidential" written upon it, will be perfectly safe; but we by no means wish "A. Z." to divulge more than he may consider his own interest requires.]

TABLE BEDSTEAD.

To the Editor of the Mechanic and Chemist.

SIR,—The accompanying drawing is of a table bedstead of my own construction, which I have had in use in my kitchen for some time, and answers exceedingly well.

Fig. 1, *a a*, shows the flap up; the dotted lines, B B B, show the flap down; *c c*, two iron legs, fit into the frame to support flap when up; D, a sliding board, which pulls out to let the bedstead down; *e e*, box for bed and clothes.

FIG. 1.

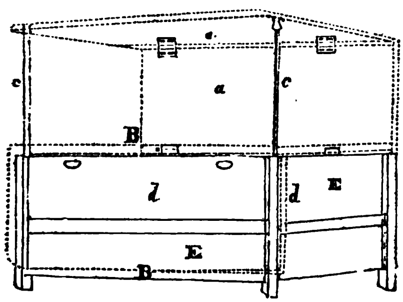


FIG. 2.

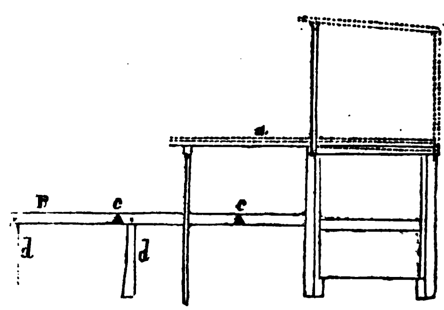


Fig. 2, *a*, shows the flap when used as a dining-table; B, the bedstead; *c c*, the joints; *d d*, swing legs. In putting up the bed, the clothes should be folded up; then turn up the bedstead, and put in the bed; then the sliding-board, and the rest of the clothes; let down the flap, and not any part of the bedstead or clothes is visible.

T. D. B——R.

BILL STICKING.

IF we were to estimate the importance of this "profession" according to the pretensions of the artists engaged therein, it would, perhaps, rank higher than any other in the kingdom. The bill-sticker considers himself the protector of commerce, the patron of the drama, and fame's chosen trumpeter. At the time of our great national conscience market, called an election, he is a statesman; and he is so open to conviction, that his opinions are always identified, for the time being, with those of his employers. His warlike feats are attested by many a bleeding nose and sable eye; he is a chevallier *sans peur*, but not *sans tache*; for he is generally half smothered in paste, before he proceeds to pugilistic operations with his rival artist. A company was projected some time ago, under the title of "external decorators," pretending to establish a monopoly of the principal "boardings" (as they term the places where bills are allowed to be posted); but it was not carried into effect. This company *pour rire*, though a failure in itself, has suggested the idea that much advantage would be derived from a bill-posting establishment, possessing the power to secure the fulfilment of their engagements, and occupying the most important "boardings" of the metropolis. This company is now formed, and engagements are entered into, granting them the exclusive right to post bills

upon most of the conspicuous and desirable places about town; and they have erected boardings to a considerable height above the original palings. There appear to be three advantages held out by this company; first, a guarantee that all bills committed to their charge, shall be posted at each of the places agreed upon; second, that precautions will be taken to prevent their premature removal, or the posting of other bills over them; and, third, that no other bill-stickers will have the power of giving the same, or near so great publicity to their bills. That some reform is required, must be admitted by all who require the services of those tenacious gentlemen; in corroboration of which, we quote the following from "Grant's London Journal:" *—

"To meet with a bill-sticker in whom entire confidence may be reposed, is not an every-day event. If you charge them with not having done you justice in the posting of your bills, and point in proof to some conspicuous dead wall, which is not embellished with one of your announcements, they are always with their answer:—'Oh, that place was properly placarded, sir.' 'How happens it, then, that there are none to be seen now?' If the weather be warm, they will tell you the heat has torn them down; if it be wet, the rain has done the work of mischief. If the weather be neither warm nor wet, 'Some other "fellow of the trade" has covered them over with his stupid old bills;' with other similar excuses.

Bill-stickers have a quick eye to all professional matters. They can anticipate, by a sort of intuition, when a shop is about to be shut up, a house to be closed previously to being pulled down, or a wooden erection to be made; and before twenty-four hours have elapsed, they will cover every inch of the space with bills of all sorts, and printed on paper of all colours.

Bill-stickers are a fraternity with whom society are at eternal war. Denunciations and threats levelled at them, meet the eye everywhere. 'Bill-stickers, beware!' is a caution to the brotherhood, which is to be seen in all parts of the metropolis. When everybody's hand is thus raised against them, it ought to make them more united and friendly among themselves. We shall expect to hear, some of these days, that a sense of reciprocal interest has induced them to give up their squabbles and scuffles, and to form themselves into a sort of mutual protection society."

* "Grant's London Journal" is a highly instructive miscellany, on the plan of the "Edinburgh Journal. The last-mentioned publication was one of the earliest in preparing the way for cheap and useful literature, and is entitled to much praise. The more extensive sources of information, and valuable original matter which distinguish the "London Journal," render it equal to any work of the kind now published."

MASTER BOOT AND SHOEMAKERS' PROVIDENT AND BENEVOLENT INSTITUTION.

There is no safer speculation than subscribing to a mutual benevolent institution like the present; for if you prosper, you cannot feel the want of the money you have subscribed, and you will have merited the esteem of your fellow-tradesmen, and, which is of still greater value, your own; if, on the contrary, misfortunes should encompass you, and you should, in your turn, need a helping hand, your former bounties will be returned tenfold; not in the humiliating form of cold misgiving charity, but as a right you claim to that relief which, in happier days, you did not deny to others. A dinner took place on Wednesday, 27th inst., at the Crown and Anchor; it was very numerously and, we need not say, respectably attended. About 130*l.* were collected, and several annual subscribers added to the list. If the advice of a disinterested friend, who is not a stranger to the world, or to human nature, may be esteemed of any value, we most earnestly recommend every man connected with the boot and shoe trade—and they are very numerous—to contribute towards the support of this excellent Institution. The following is an extract from the Report of the Committee:—

"The Committee of the Master Boot and Shoemakers' Provident and Benevolent Institution hail the return of another period, when they are called upon, by the rules of the Society, to lay before the subscribers a statement of its affairs.

At each preceding anniversary, it has been their pleasing occupation to relate the steady progress of the Institution; and thankful are they, on this occasion, to make known that it still advances in numbers and respectability.

Your Committee feel assured it will be matter of congratulation for you to hear, that the conflicting opinions which invariably met their earlier efforts, are fast wearing away; even now the Institution ranks among its supporters those who are occupied in every branch of the trade; thus presenting, in miniature, that which they believe will, ere long, be seen in all its fulness—viz., a body of men, engaged in

the same pursuits of life, uniting hand and heart to alleviate the sufferings of those among them, whom Providence may ordain to be less prosperous than the rest.

During the past year, there has been an addition of fifty-three donors and subscribers, making a total of 520. By the cash account about to be submitted to you, it will be seen that the sum of 550*l.* has been invested; one-half of which is added to the building and endowment fund, the remainder to the fund for relieving those whom, ere long, you will be called upon to elect as recipients of your bounty; thus, towards the first great object, we have already the sum of 1631*l.* 17*s.* 10½*d.*, and for the other, 275*l.* 13*s.* 8½*d.*

These brief statements, your Committee trust, are enough to show they have not been unmindful of the trust committed to them. Far, however, from taking credit to themselves for all that has been done, they would rather express their sense of the valuable aid you have rendered in carrying out their plans, and in encouraging themselves and you by a retrospect of the past, would urge each to look at the great work to be accomplished. It is, indeed, gratifying, when we glance at the first printed Report in 1837, wherein is stated, that 486*l.* had been funded, to find on this night that sum augmented to 1917*l.* 5*s.* 2*d.*; yet if we take another view, and compare our 520 subscribers with the 2000 persons who compose the trade in London and its vicinity, to say nothing of that vast number throughout the country (who, by subscribing to the Institution, be it remembered, are equally eligible to become candidates for its benefits), we shall soon perceive that, far from resting on past achievements, our motto must be, as it then was, 'perseverance.'

Your Committee would remind you, that the period is not far distant, when those who were connected with the Institution from its commencement, will be so far admissible as candidates for relief. In all probability the widow and orphan will first seek your aid; and can there be objects presented to your sympathy, whom you would more willingly relieve? O, it is cheering in the midst of the difficulties which beset us in our good cause, to remember, these are they we seek to succour!

In conclusion, your Committee would express their earnest desire, that none here present may ever need the assistance towards which they are contributing, knowing that it is ever 'more blessed to give than to receive.'"

LONDON JOURNEYMENS' TRADES' HALL.

Report of the Provisional Committee submitted at a Special Meeting of the Shareholders on Tuesday, 26th May, 1840, in the Temperance Chapel, Aldersgate Street.

The peculiar and important object for which the shareholders are assembled on the present occasion, dictates to the Provisional Committee, that they owe an imperative duty at the moment of their retirement from office—to submit an unreserved statement of their proceedings up to the present time, in the promotion of the erection of a Trades' Hall, and their opinion of its present and future prospects.

The agitation of a proposed Trades' Hall, which has led to the formation of your present undertaking, was originally commenced by the circulation of some small and general prospectuses among a few individuals, chiefly belonging to the book-binding trade; by whom it was so well received, that a preliminary meeting was convened by circular, and by an advertisement in the *Charter* newspaper, and the same was held on Monday evening, 11th July, 1839, in Providence Hall, Finsbury Square; at such meeting your Provisional Committee were appointed, with power to add to their number.

Their first business was, to locate themselves in as central a situation as possible, for giving effect to their proceedings; a large room was engaged at the Suffolk Coffee-house, 16, Old Bailey, for their weekly meetings, at an expense of 2*s.* per night. A spirited address was at once drawn up, and 500 copies printed for distribution to the trades of London, as far as it was possible to get at their places of meeting; the appointment of delegates from each to meet and confer with your Committee, was strongly urged in these addresses; and on the 16th of August and subsequent meetings, delegates from numerous trades' lodges and societies, attended, until the plans and intended operations of the undertaking had been so far matured, as to enable them to report to their respective bodies the information which they were appointed to collect. From this union of delegates with your Provisional Committee, another prospectus, in a pamphlet form, was drawn up, and 1000 copies circulated among the trades of the metropolis and the public generally. The design, object, and constitution of the Trades' Hall, were severally elucidated in this publication, and the

principal fundamental features of the subsequent laws of enrolment were delineated, and very generally approved. The amount of capital required was, on the rude calculation of a respectable architect, fixed at 15,000*l.*, being an estimate of 10,000*l.* for the building of the Hall, and the remaining 5000*l.* for the purchase of the ground and incidental expenses.

About the same period, your Committee and other shareholders furnished themselves with fifty collecting-books, which were found extremely useful in securing the names of parties who would otherwise have shrunk from the necessity of coming to the Trades' Hall Office to register their names. These books were at once rendered subservient to the collection of the deposits on shares, which were accordingly commenced being received in October; and your Committee very early took the precaution of appointing (in the spirit of your proposed laws, which were not then published) a Finance Committee of three from their number, in whose hands, from time to time, the money which has accumulated after the payment of the necessary bills and rent, has been deposited in nearly equal proportions. This provision was rendered necessary in the uncertainty of success, to guarantee, as much as possible, against anything like an attempt at imposition; more especially as no amount was received at any one time, sufficiently large to commence an account with Messrs. Prescott, Grote, and Co., who very readily consented to become the Trades' Hall bankers, when their services should be required in that capacity. The payment of deposits has never been particularly pressed, so long as sufficient finances have come in to meet the current expenses. The value of collecting-books has been felt on all hands, and they have consequently been widely circulated—there being at this moment about 170 in the hands of shareholders, secretaries of trade societies, and others who are friendly to your project.

The increasing demand for a code of laws for the government of the undertaking, led to the appointment of a sub-committee in November, for the compilation of so important a document; the result of their labours is in your hands, in the printed laws with which each shareholder is furnished on registration. The enrolment of those laws was effected in December, and 1000 copies being printed, their general distribution took place at the commencement of the present year; abstracts of them have been extensively promulgated among trades' unions, lodges, and all public meetings where their circulation was at all likely to promote the success of your undertaking; in this manner 10,000 of these abstracts have found their way among the public.

The concluding proceedings of your Committee have been the two public meetings on the 9th March and 11th May, in the Mechanics' Institution, Southampton Buildings, Holborn. The effect of those meetings is very generally known; and it is sufficient to state, that they were, on both occasions, well attended, and have very manifestly created a spirit of inquiry as to the objects and advantages of a Trades' Hall.

Thus far we have detailed our proceedings, to give effect to the London Trades' Hall, in the success of which, your Provisional Committee are most deeply interested; whether the measures adopted by them shall receive your approbation or not, they have not been adopted and persevered in, without mature reflection as to their necessity and practicability.

What is now the present position of your important undertaking? 1050 shares are already applied for, while numerous collecting-books, containing the names of persons requiring shares, have not yet been returned to your Committee. The number of persons holding shares and actually registered in your share-books, is 604, including the different trades. Deposits have been received on 702 shares, and the remainder of the shares being more or less introduced into the share-books by registered shareholders, give a guarantee for the responsibility of the individual holders.

Your Provisional Committee dwell with much pleasure on the gratifying fact, that a spirit of enthusiasm prevails among the shareholders in behalf of your undertaking, which betokens, in their opinion, its ultimate success; and at this early stage of your existence, your Committee have received the promises of many of your shareholders to take additional shares, so soon as 7500 are registered. In this feeling, which is likely to be very generally participated in by the shareholders, your Committee gladly identify themselves, from a conviction that the progress of the London Journeymen's Trades' Hall is sure and certain.

The support of your several trades, individually and collectively, forms a most important principle to be aimed at; designed as your project is, peculiarly to suit the convenience of these large bodies of operatives, they must be early and effectually moved to recognize its claim on their prompt adherence. It is the anxious

wish of your Provisional Committee, to impress on the attention of their brother shareholders, the urgent necessity of using their individual exertions in their trades to accelerate this successful step, which would at once place the success of a Trades' Hall on the high ground of certainty. It is pleasing to know, that the agitation of its merits is going on in various quarters, and, in several trades, their influence and co-operation is anxiously looked for.

The Finance Committee will submit their report of receipts and expenditure as audited by three shareholders, who have not been connected with the Provisional Committee. The most rigid regard to economy has been scrupulously observed; and it will be seen, on reference to the auditor's balance sheet, that the expenses entirely consist of rent of office, expenses of two public meetings, printing, and stationery.

In conclusion, your Provisional Committee feel no hesitation in declaring themselves satisfied with the progress of your undertaking, in the few months that it has been before the public. However great may have been your exertions in common with themselves, to diffuse a knowledge of its utility and existence, it is still a fact (which ought to stimulate to greater exertion on the part of its friends and admirers), that, among our own class, are numbers still to be found, to whom the name of a Trades' Hall is wrapped in obscurity; of its design they are lamentably ignorant, and of its benefits to themselves and society at large, they are, consequently, strangers. These at present, therefore, can render us no efficient aid; they are obstacles in your path: let it be our duty to press forward and surmount every difficulty. The beams of intelligence will in time illuminate these dark spots in our passage, and create for us active friends where all is now lethargy and prejudice.

We leave our posts in your hands—we retire from onerous duties with a firm conviction that we have wished for the best, and aimed at the best; and, having done so, we leave to our successors, whom you may appoint this evening, the consummation of our labours and desires. We look for great things: the number, influence, and power of our class, warrant your Provisional Committee to expect them. Let the working men of London rally round themselves with the beacon of united intelligence in their centre, and the fiat of their wisdom will at once call into existence the great shield of their order—the tower of their intellect—the pride of the metropolis—the monument of labour—the heir-loom of industry—THE LONDON TRADES' HALL!

THE CHEMIST.

ON ALKALIES.

(Continued from page 31.)

JERVINE (Vegeto).—An alkaline base, which is obtained, by a complicated process, from the roots of the white helebore, in which it exists, along with veratia. It is closely allied, if not identical with sabadilline. It forms insoluble salts with sulphuric, hydrochloric, and nitric acids, and soluble salts with acetic and phosphoric acids. They are all decomposed by boiling with carbonates of the fixed alkalies.

Lime (Earthy).—Of all the alkalies, this one is of the greatest importance in the arts and manufactures. The most extensive employment of lime is in agriculture; it is also used in a multitude of preparations subservient to the arts—for clarifying the juice of the sugar-cane and beetroot; for purifying coal gas; for rendering potash and soda caustic in the soap manufactories; for the bleaching of linen and cotton; for clearing hides of their hair in tanneries; for extracting the pure volatile alkali from muriate and sulphate of ammonia; for mortar cements, and as a flux by iron-founders, &c. Lime is never found native (that is, in its pure state), but always in a state of combination, generally with an acid, and most copiously with carbonic acid—as in chalk, marble, and limestone, which are all carbonates of lime in various states of aggregation. Lime is extremely caustic: if water be sprinkled on it, great heat* is produced, and the water unites with it, forming a hydrate of lime. It is partially soluble in water, with this singular condition, that it is more so in *cold* than in *hot*; the solution, which is called lime-water, possesses alkaline qualities. A striking experiment may be performed with this solution:—A small quantity being poured into a wine-glass, blow through the liquid with a piece of tube; after a minute or so, this *transparent* and colourless liquid becomes an *opaque* milky one. In this experiment, the carbonic acid of the breath, in passing through the

* The heat arising in this case, and when water is poured on baryta, fused potassa, &c., is caused by the latent heat of the water being given out on its becoming solid by its union with lime, &c.

iquid, combines with the lime, and forms carbonate of lime or chalk, which is insoluble in water. A solution of muriate of lime mixed with alcohol, tinges the flame of the spirit of a brick-red colour.

Lime was thought to be an elementary or simple substance, until it was decomposed by Sir H. Davy, who found it to consist of oxygen and a metallic base, which he denominated calcium. Oxide of calcium or lime, consists, according to his analysis, of

Calcium	72.8
Oxygen	27.2
	100.0

Lithia (Earthy).—Is an alkaline earth, discovered, not many years ago, in a mineral called petatite and triphaur, found in a mine at Uto, in Sweden. The following is M. Aywedson's (the discoverer) process for obtaining it from the former mineral:—Having reduced the mineral to a fine powder, it is to be fused with half its weight of potassa. The fused mass is then to be dissolved in hydrochloric acid, filtered and evaporated to dryness. It is then to be digested in alcohol, which dissolves the chloride of lithium; by a second solution and evaporation, it is obtained pure. Its aqueous solution has then to be digested with carbonate of silver, by which a carbonate of lithia is formed, which is to be decomposed by lime. Like other alkaline carbonates, lithia is white, very caustic, has a sharp burning taste, and destroys the cuticle of the tongue. Like potassa, it is soluble in water, and slightly so in alcohol. The flame of alcohol holding chloride of lithium in solution, burns with a purple colour. Lithia is most remarkable for its power of acting upon, and corroding platinum. When the hydrate of lithia is submitted to the action of the Voltaic pile, it is decomposed; a white, brilliant, and highly combustible metal is separated at the negative pile, and oxygen at the positive. Lithia is composed, according to Gmelin, of

Lithium	50
Oxygen	50
	100

This alkali is distinguished from others, by Berzelius, in the following manner:—By the fusibility of its salts; by the liquefaction of the carbonate at the moment it is heated to redness; by its great power of saturating acids.

SEPTIMUS PIESSE.

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, June 11, Harman Lewis, Esq., B.A., on German Silver. At half-past eight.

Poplar Institution, East India Road.—Tuesday, June 9, T. E. Bowkett, Esq., on Vitality. At eight o'clock precisely.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, June 10, a Lecture on Mechanics. At eight o'clock.

QUERIES.

How to prepare phosphuretted ether?

E. J. & Co.

The best method of producing the dead colour on gold and gilt articles? G. M.

TO CORRESPONDENTS.

J. B.—*The machine he describes is merely a syphon; the water can never flow out of the shorter arm, whether the tube be capillary, or of large dimensions. Any porous substance will form a capillary syphon; a piece of blotting paper, or pack-thread, placed with one end in a cup of water, and the other hanging outside, will cause all the water in the cup to pass through, and drop off at the lower end of the syphon; but if that end be no lower than the surface of the water in the cup, the water will not flow; and if a drop be hanging to it, instead of accumulating, it will be absorbed, and conveyed into the cup; the inner arm being the longest. This is exactly the case in " J. B's." machine.*

Epictetus.—*The process of photography is fully described in No. 43, N.S., of the " Mechanic." To prevent the deterioration of the drawings by exposure or contact, it is recommended by M. Dumas to pour upon the plates a boiling solution of one part of dextrine in five parts of water, which deposits a thin coat of varnish, sufficient to effect the desired object.*

John Osbaldeston *would oblige us by sending either an abstract of his specification, or the date of the sealing of the patent granted to him for his metal healds. We have received favourable reports from productives who have witnessed their operation, and shall be happy to promote their adoption, by publishing a description and, if necessary, an engraving of them.*

A. Z.—*We feel deeply interested in the subject of his communications. His letter on the new process of gilding, we think, might be published without any prejudice to his future views; and, if he will inform us of his intention in that respect, it shall appear next week.*

London: Printed at " THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

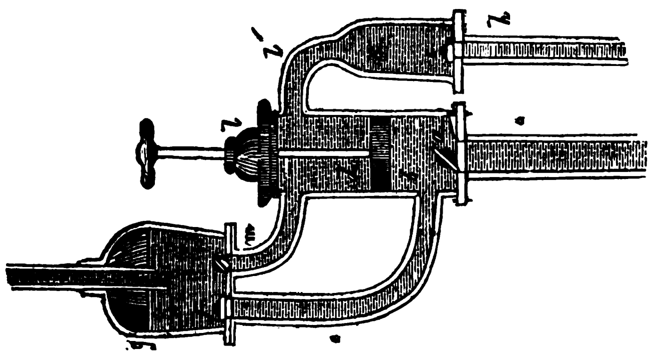
THE

MECHANIC AND CHEMIST.

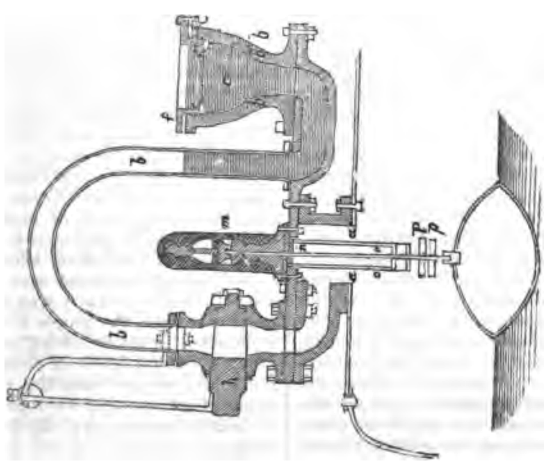
A MAGAZINE OF THE ARTS AND SCIENCES.

No. 96, NEW SERIES. | SATURDAY, JUNE 13, 1840. PRICE ONE PENNY. | No. 217, OLD SERIES.

DE L'HIRE'S LIFT AND FORCING PUMP.
FIG. 3.



POOLE'S PATENT APPARATUS FOR STEAM BOILERS.



City Press 1, Long Lane, Aldersgate Street: D. A. Doudney.

POOLE'S PATENT APPARATUS FOR STEAM-BOILERS.

(See Engraving, front page.)

The slightest improvement in steam machinery becomes important, when its application is general; but no consideration of economy, or even superior result of action, deserves so much attention and patronage, as those inventions which are directed to the prevention of accidents. Mr. Poole's patent is of this nature; and we feel pleasure in laying before our readers the following copious abstract from his specification.

"The invention relates, first, to a mode of applying thin surfaces, to be burst by any material increase of pressure of steam in the boiler, and in such manner, that other such surfaces may be readily replaced, without the boiler being put out of work by the bursting of a surface; thus offering a means of safety for the escape of steam, which can be at all times depended on.

Secondly, to a mode of applying a whistle to steam-boilers, in order to indicate when the water is below the proper working line. And in order to give the best information in respect to the invention, in my power, I will proceed to describe the engraving hereunto annexed.

Description of the Engraving.

The engraving represents a portion of a steam-boiler, with the improvements applied thereto. The apparatus being in section, in order to the same being readily understood, *a* is an opening in the steam-boiler, at which the apparatus is applied; *b* is a tube or way through which the steam can pass, as indicated by the drawing; *c* is an enlarged end of the tube, *b*, and it is in this part of the apparatus where what I call the bursting or safety-plate or surface is applied; *d* is the bursting or safety-plate, which is pressed on by the ring, *e*, such ring having a bell-mouth, in order to prevent the edges cutting the bursting or safety-plate, when pressed on from below; *f* is a ring with a flange, which screws into the upper part of the end of the tube or way, *b*, and by such means secures the safety or bursting-plate in its place, the surface on which the plate, *d*, rests, being formed with an elevated ring or surface, over which the plate, *d*, is bent, in order that the holding around the edges may be the more secure; *g* is a padlock by which the flanges of the ring, *f*, and the upper end of the tube, *b*, can be secured, and thus prevent any person removing the safety-plate or surface, *d*, unless with a key to open the lock. I would remark, that although the above mode of apparatus for affixing the plate, *d*, in its place, is very convenient and simple, I do not confine myself thereto; as the mode of affixing the plate in its place may be varied without departing from the invention; *h* is a cock, the plug of which is also capable of being locked and secured, as is shown in the engraving. The end of the tube, *b*, is filled with water, and both under and over the plate, *d*; the object of which is to keep the plate, *d*, at an equal temperature. In working with this apparatus, in the event of the steam getting higher than the pressure, it is determined (above the working pressure of steam), the plate, *d*, will burst, and permit the steam to flow off, and thereby reduces the excess of pressure in the boiler, and the plate may be then replaced, without stopping the working of the boiler for the purpose of the engine; and the replacing of the burst-plate by another is performed by shutting the cock, *h*, and removing the bursted plate by unscrewing the rings, which retain it in the end of the tube or way, *b*, and then placing a fresh plate, *d*. I have called the whole of the apparatus a tube, *b*; because, when combined together, the parts, in fact, make one continuous bent tube or way, and the nature of the parts being clearly shown in the engraving, no farther description thereof will be necessary, and the construction thereof may be varied. It should, however, be remarked, that it is important that the opening at b_1, b_1, should, on the one hand, be sufficiently large to relieve the boiler of the excess of pressure when the bursting takes place, and yet not be so large as to cause so powerful an explosion as to be injurious to the boiler; and it has been found desirable, in carrying out this invention, to observe the French rule, directed by the Royal Ordnance, the 29th day of October, 1823, of making the size of the opening in proportion to the heating surface of the boiler, which is as follows—having measured every portion of the boiler, which in any way can be called heating surface, the proper size of opening is obtained in the following manner:—engineers, in the habit of making calculations, will easily obtain the required diameter of an opening for a particular area of heated surface, by the following formula:—

$$D = 1,3 - \sqrt{\frac{c}{n - 0,412}} \quad . \quad . \quad . \quad A$$

In this formula, D represents the diameter desired to be obtained, expressed in

centimetres; *c* is the measured diameter surface of the boiler exposed to the action of the fire, whether directly or indirectly, by flues expressed in square metres; *n*, the quantity of the working pressure of the boiler and the result; A will be the value of D, or the diameter of the opening, *b'*, *b'*. The material I employ for making the plate, *d*, is lead; but I do not confine myself thereto, as the invention does not consist in the using of weak places in boilers; nor does it consist in the material of which such weak places are made. But the invention consists of a mode of applying such thin bursting or safety-plates or surfaces, and in such manner, that the boiler should not be put out of work by the bursting of a safety-plate or surface, the apparatus offering a ready means of applying a fresh safety-plate. The following is a table of thickness of lead applicable to the purposes set forth.

Diameter.	1½ Atmosphere.	2 Atmosphere.	2½ Atmosphere.	3 Atmosphere.	4 Atmosphere.	5 Atmosphere.	6 Atmosphere.	7 Atmosphere.
Inches.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
$6\frac{11}{16}$	$0\frac{1}{128}$	$0\frac{2}{128}$	$0\frac{3}{128}$	$0\frac{4}{128}$	$0\frac{6}{128}$	$0\frac{9}{128}$	$0\frac{12}{128}$	$0\frac{16}{128}$

Note, it should be stated, that the above title is formed as if the bursting was into a vacuum; but as there is the atmosphere at all times external of a steam-boiler, the table, in fact, commences with a working pressure of half-an-atmosphere. It will be evident, that if the diameter of a given thickness of plate be increased, it will burst at a lower pressure of steam, and if the diameter be decreased, it will require a greater pressure to burst it; consequently, by a few trials, the thickness and diameter may be obtained for any degree of pressure desired. It should be stated, that the steam-way or tube, *b*, should, at all times, be as large as the opening, *b*ı, *b*ı; but preferably somewhat larger. In using the above-described apparatus, it may be employed separately as a means of safety, or conjointly with any of the ordinary safety-valves; and, in using it with other safety-valves, the common safety-valve should be so weighed as to allow of being lifted, and admit of the passage off of steam at a pressure a little less than would burst the plate, *d*.

I will now proceed to describe the second part of the invention. At an opening in the boiler is affixed a whistle, such as is shown at *m*, having a plug, *n*, to fit the opening, the plug being in direct communication with, and attached to a float; such float, it is preferred, should be of light wood, encased in copper; *o o* is a framing, which serves to keep the rod and plug, *n*, upright and correct to its work; *p p* are weights. It will be evident, that so long as the water is up to its proper working line, the plug will be closed; but if the water sinks, the plug will descend, and the rush of steam through the whistle will indicate the want of water, and the noise will cease, so soon as the proper water-line is again attained."

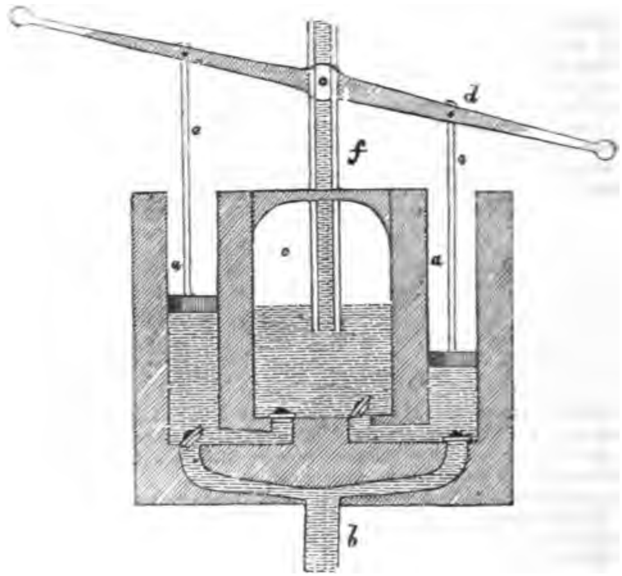
HISTORY AND APPLICATION OF THE PUMP.

NO. III.

(Concluded from page 2.)

AMONG the variety of useful purposes to which the forcing-pump is applied, there is one which particularly deserves attention—viz, the fire-engine. It consists of two forcing-pumps, *a a*, fig. 1, supplied with water by the feeding-pipe, *b*, which are made to discharge their contents alternately into an intermediate air-chamber, *c*, by means of a working handle or lever, *d*; the piston-rods, *e e*, are attached to each side, and at a short distance from the centre or fulcrum upon which the lever works; by which arrangement each piston will be alternately elevated and depressed, and the air-vessel will be continually receiving a charge from either of the pumps; so that the air contained therein, being a much lighter and elastic fluid than water, will, of course, occupy the upper part of the chamber, where it soon becomes condensed to such a degree by the pressure of the water from beneath, that it forces the water contained in the air-chamber up the pipe, *f*, with considerable force. The lower end of the pipe is at all times beneath the surface of the water; and to the upper end, the flexible leather pipe or hose is attached, for the purpose of conducting the current in any required direction.

Fig. 1.



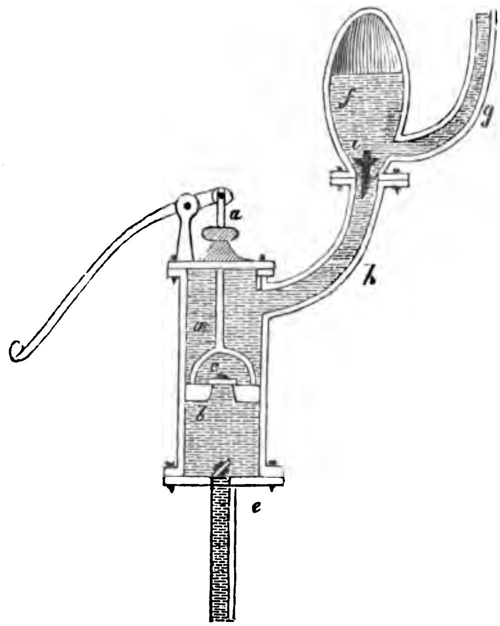
Another form of the forcing-pump is shown at fig. 2; yet as this partakes of the construction of the lift-pump as well as the forcing-pump; it is generally denominated the lift-and-force pump. The following is a description of its construction:—*a*, the working barrel or body of the pump, having a perforated piston, *b*, with a valve, *c*, opening upwards, working within it as in the common lift-pump; *d*, the piston-rod working in an air-tight stuffing box; *e*, the feeding-pipe; *f*, the air-vessel; and *g*, the discharging pipe. Its action is like that of the common lift-pump, with this exception, that instead of discharging its contents from a cistern at the top of the working barrel, as is the case with the common pump, it is conveyed by the elevation of the piston, along the lateral pipe, *h*, where it lifts a small circular plug, *i* (which is made to fit the end of the pipe with great accuracy), before it enters the air-vessel; which having done, the reaction of the compressed air forces the plug again into its place, and then displaces the water it has received from the barrel of the pump, through the discharging pipe, *g*, which proceeds from the bottom of the air-vessel, while the piston is descending for the purpose of giving another stroke. This kind of pump is rather more complicated in its construction than the forcing-pump before described,* and, consequently, more expensive; although it cannot be said to possess many advantages over it. Both kinds are, however, most extensively adopted in water-works for supplying large cities and towns, for raising water from mines and other deep situations, and also in large manufactories, distilleries, &c.; and we rarely meet with one of those gorgeous Bacchanalian temples that does not possess one, at least, of those bright-looking brazen-bodied forcing-pumps of the first construction, for pumping up the *fiery liquid* from the regions below, into those finely-painted casks which generally surround the interior of those demoralizing places.

Fig. 3 (see engraving in front page) is a lift-and-force pump, the invention of M. de l'Hiré, which raises an equal quantity of water by its up, as well as its down stroke; thereby producing the full effect of two pumps with a very little friction. Now in the forcing-pumps before described, it will be seen, that after

* See "Mechanic," No. 90, N.S.

the piston is depressed, and the water has been forced away from the interior of the pump, it must reascend, and a second depression of the piston take place before any more water can be discharged. The piston, therefore, in its reascent, performs no other office than that of forming a vacuum in the working barrel. In the pump

Fig. 2.



of M. de l'Hiré, however, the piston performs a double office; for instance, when the piston, *a* (the rod of which works in a perfectly air-tight stuffing box, *l*), is elevated, a vacuum is formed in that part of the cylinder, *b*, below the piston, consequently the water is forced up the feeding pipe, *c*, through the valve, *d*, into the body of the pump, by the external atmospheric pressure; and, upon the lowering of the piston, the valve at the top of the feeding-pipe closes, and the water is forced up the lateral pipe, *e*, through the valve, *f*, into the air-chamber, *g*. Thus far it resembles the ordinary forcing-pump; but, during this operation, since no air can possibly enter the pump, a vacuum is, therefore, being formed in that part of the pump above the piston, which is supplied with water by a second feeding pipe, *h*; having a stop valve, *i*, opening upwards into the chamber or cavity, *k*, which terminates in a pipe, *l*, opening into the top of the pump; so that when the piston descends, that part of the pump becomes filled with water, and, upon the ascent of the piston, that water (since it cannot return to the feeding pipe in consequence of the closing of the valve, *i*) is, therefore, forced up the other lateral pipe, *m*, which has also a valve at the top, opening upwards into the air-chamber; so that the pump, when in action, constantly discharges as much water as two forcing-pumps of the ordinary construction would, with the friction of one pump only.

EPICTETUS.

ABBOTT'S PATENT FOR IMPROVEMENT IN THE MANUFACTURE OF FELT.

According to the ordinary mode now pursued for making felt, the hair or other materials employed is obtained in the form of what is called a bat, by the process of bowing, or otherwise, as is well understood, which bat is slightly pressed on by the workman by a surface of open basket-work, and the bat is then placed in a cloth in such manner as to enclose the bat on all sides and surfaces. The bat so prepared then undergoes the process of felt-

ing by the hands of the workman—he from time to time damping the fibres with water; and the process of felting consists in pressing on the surfaces with the hand, and from part to part of such surfaces; by which motion is communicated to the fibres, which is the cause of a creeping action taking place of the fibres among themselves, which causes them to interlock and intermat; such process being carried on by the workman on a heated slab or bench of iron (kept hot by steam or other convenient means), the workman occasionally examining the progress of his work, and by holding the sheet under operation, when taken out of the cloth, before the light, he ascertains whether there are any thin places; and if there should be any, he places a quantity of hair or other fibre, which he judges sufficient to make good such places. He then again places the partially prepared sheet of felt in the cloth, and proceeds by pressing with his hands progressively over the whole surface, which is upwards, occasionally turning the sheet over to bring up the other surface; and this process is pursued till the required degree of felting is obtained. Now the principal object of this invention is, to make sheets of felt from hair, such as are now made by hand, and are used in ship-building, and also in railways and for other purposes; but the invention is not confined to hair. I would remark, that I have been thus particular in calling attention to the process now pursued, in making sheets of felt by hand, by enveloping the bat under operation in a cloth, and working by hand pressure, as is well understood; because my invention consists in the application of a system of rollers, to press and work the bats of fibres within or between such cloths, in substitution of the hand pressure and working above spoken of, and which is well understood; and it should be stated that, according to my invention, the process is to be carried on, according to the well-known means now pursued, up to the time that the bat of hair or other fibres is enveloped in a cloth, when it is to undergo a process of rolling and pressure by rollers, on a similar heated surface to that now employed; and during such process of pressure and rolling, the workman will, from time to time, moisten the cloths, and will turn the bat over from side to side, and will examine the sheet of felt as it proceeds, in order to ascertain whether there are any inequalities; and, in fact, he will in all things, excepting using roller pressure in place of hand pressure, pursue like means to those now resorted to in making felt by hand.

A series of grooved wood rollers are contained in a quadrangular frame, with handles by which the workman moves the frame of rollers to and fro on the upper surface of the cloth containing the bat of fibres.

In using this apparatus, the workman places the cloth containing the bat of fibres on to a table or bench, similar to that now employed, properly heated; and he stretches a cotton or other surface of cloth over the cloth containing the fibres; and the object of such second cloth so stretched over is, to prevent the bat and its cloth being irregularly acted on at its edges, which are apt to turn and move up, unless a cloth is stretched over; and for this purpose I have pins, or other means of fixing the covering cloth at the sides, so as not to give way when rolling with the rollers. The workman, from time to time, turns the bat under operation, and examines the progress of felting, in order to make good any thin places; and he applies water or other fluid, as usually employed, from time to time, as the felting proceeds, and as is usually done in performing the process of felting by hand. The workman simply moves the frame to and fro, in place of the hand pressure formerly applied. In other respects, the process of felting hair or other fibres, is to be pursued as heretofore.

LIFE ASSURANCE.

NO. VI.

MUTUAL SOCIETIES.

SINCE we have made some observations upon societies which are founded upon the system opposed to candour and open-dealing with the public, let us beg the reader's consideration of the system of mutual assurance, upon one or two of its principal features.

A Mutual Society is built upon a broad basis of equity; it aims at the highest advantages for all its members; it unfolds its whole transactions to them; it selects its managers from among the assurers or real members, and distributes among them equally all the fruits of its success. Now, it will appear perfectly plain, that this method is very unlike the proprietary principle, which is the plan adopted by the generality of societies. But, it may be asked, if it is not on that account the more just? Suppose a person assure in one of the companies whose object is merely to pay the sum, on a certain contingency, for which such person stipulated; will it be supposed that that person will feel the

slightest interest in the advancement of that particular Society more than any other; or that he will be contented, through the whole of his life, to pay monies for which he is well assured no other return will be made, than the aforesaid promised sum, although his long run of premiums may very far exceed that sum in amount? This speaks for itself—that there is no accumulating benefit for the assurer, but rather a disadvantage in the event of a long life. But, in a Mutual Society, neither does the advantage that arises for each member respectively, in the shape of profit, ever cease, while he remains a member of that Society; nor are his eyes closed to its *bonâ fide* transactions; nor the privilege denied him, at any time, of advancing as one voice, whatever he may deem necessary for the good of the Institution. In fact, he has become, and is recognised as a part or portion of such Society, without whose assistance the construction of the whole fabric would be but imperfect. We feel aware, that we may be thought as speaking in too partial a manner of the system of mutual assurance; but let the reader examine, as we have done, in the most careful manner, all the various methods of the societies now before the public, and the idea, that our partiality extends beyond a reasonable consideration of the matter, will instantly vanish. Of course, to those who have paid but slight attention to the subjectof Life Assurance, these facts are not so obvious; and as we have only undertaken here to explain a few of its principles, we have purposely avoided more direct remarks upon different societies at present, but which will follow hereafter.

It may now be mentioned, that a Mutual ociety has no need of a raised capital, save any trifling consideration among several of its members; a thing which the public never hear of, and which disappears of its own accord. We know, for a fact, that the Mutual Society in the Old Jewry never did raise a sixpence by way of capital; and having stood a severe test for six years, it cannot now be thought it will ever be required to do so. In the same manner, others have followed their example; it being held on the authority of our first-rate actuaries*, that such a capital is nothing better than a burden, either at the onset, when no premiums have been collected, or after having received some premiums, and, consequently, a fund in hand; or, after the period of several years, providing the premiums were made lower in consequence of such capital; and, we would modestly add—let what period intervene that may—it ever will be a burden.

It has been thought by some, that a serious responsibility attaches itself to every assurer in a Mutual Society, and that whatever deficiency may occur in its funds, must be borne by the several members; but this idea has no footing. If, as we have before observed, a certain number of members engage (as, perhaps, they generally do) to raise something in the shape of money, should it be needed, then their responsibility extends so far and no farther, and this is a very prudent step to be taken; but to suppose that this responsibility rests even on such parties, beyond two or three years, is utterly absurd, when we consider how many premiums are paid in that time, which in themselves constitute the capital of the Societ. And where, we would ask, can you suppose any Society, whether Proprietary or Mutual, will find its real capital, but in the form of those very contributions from the several members? Then the question is quashed at once, who should have the oversight of the management of a Society? since the assurers raise the capital, and the proprietors or shareholders do not. They may, perhaps, resemble the offspring of a certain bird, which, after having been hatched in the warm nest of another, not its parent, it makes its tender young ones its prey, in return for the weighty obligation.

Since we have remarked, that mutual societies make their members their managers, we may just glance at the probability of their exerting their utmost to preserve economy in every such Society, were it merely for their own sakes; this, united with the effort everyone uses to bring fresh assurers or members (which limits the expenses of advertisements), contributes, in a very great degree, to increase their real capital; and we shall not be surprised to find, in connexion with this, that, in a like space of time, the number of members of such a Society will be nearly double the number in any Proprietary or Mixed-proprietary Company, notwithstanding their enormous outlay in advertisements of every kind, and their astounding assertions of security in their falsely stated capital.

We might pursue these remarks much farther, were it thought necessary; but we will conclude the present chapter with an allusion, once for all, to the cheapness

* Mr. Finlaison, the State Actuary, Professor De Morgan, of Cambridge, and Mr. Morgan, actuary of the "Equitable Society of London."

of societies. It will, doubtless, be found, that the tables of a Mutual Society are somewhat higher than those of other offices; but this will apply to the greatest advantage to assurers. When we consider that they do not charge for privileges which they do not afford, but that every possible gain realized by interest—and they have abundant means of making it —and every success of whatever nature, must ultimately fall back into the assurer's hands; we can find but one opinion remaining, and that is, whatever any description of Society may propose to give to the public of its profits in part—under any contingencies of security or non-security—no plan can surpass the just and equitable division of all the profits among all the members; in whom alone every man of common sense must see all kinds of security are vested. For proof of this, look at the great model of mutual assurances, "The Equitable Society;" their original plan in no way differed from that which we have stated, save, perhaps, in an undue degree of caution, which was adopted to obtain that experience upon which we may now with safety journey; and societies, in lieu of making their divisions of profits every ten years, can now do so every year with as little risk. In our next chapter we will give some illustrations of different societies at present existing.

SIGMA.

MISCELLANEA.

Expansion of Air.—The expansion of air for every degree of the thermometer, is, according to Gay Lussac, $\frac{1}{480}$th of its bulk. Dalton states it to be $\frac{1}{483}$rd; Roy $\frac{1}{410}$th; and La Place $\frac{1}{448}$th. The experiments of these philosophers have also determined, that all gaseous bodies undergo the same expansion by the same addition of heat, and at all temperatures. W. W.

To Destroy Worms, or prevent them from Injuring Books.—There is a small insect (*aglossa pinguinalis*) that deposits its larvæ in books in the autumn, especially in the leaves nearest the cover. These gradually produce a kind of mites, doing no little injury. But the little wood-boring beetles (*anobium pertinax* and *ariatum*) are the most destructive. M. Peignot mentions an instance where, in a public library but little frequented, twenty-seven folio volumes were perforated in a straight line by the same insect, in such a manner, that on passing a cord through the perfectly round hole made by it, these twenty-seven volumes could be raised at once. The seat of the mischief appears to lie in the binding; and the best preventive against their attacks is mineral salts, to which all insects have an aversion. Alum and vitriol are proper for this purpose, and it would be advisable to mix a portion with the paste used for covering the books. It has been recommended to bookbinders, to make their paste of starch instead of flour; also to slightly powder the books, the covers, and even the shelves on which they stand, with a mixture of powdered alum and fine pepper; and to rub the covers of books with a piece of woollen cloth, two or three times a-year, steeped in a solution of powdered alum, and dried.

Loss of Power by Friction.—This, in most machines, is averaged at about one-eighth of the power applied. The fewer and more polished the parts, the less, of course, the friction. A machine may be constructed of so complicated a nature, and of such rough materials, as to be rendered useless by the amount of friction generated.

P. P.

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, June 18, Harman Lewis, Esq., B.A., on German Silver. At half-past eight.

Poplar Institution, East India Road.—Tuesday, June 16, Allen Devonport, Esq., on the Philosophy of Wealth. At eight o'clock precisely.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, June 17, a Lecture on Electricity. At eight o'clock.

TO CORRESPONDENTS.

G. W. B.—*Neither perpetual, nor any other motion, would result from the combination he describes.*

W. H. Hewett's *valuable discovery in gilding, will appear in our next.*

S. P.—*When the engraving is ready.*

Scientia.—*The publication of the paper to which he refers, has not been intentionally delayed: we will endeavour to find it.*

Delta.—*The most convenient form for the boiler in a small steam-engine model, is a cylinder with convex ends. Its capacity should be many times that of the working cylinder; otherwise an equal pressure cannot be preserved; and the frequent necessity of renewing the water would occasion much inconvenience.*

We have received communications from various correspondents, which will be inserted or noticed in our next.

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

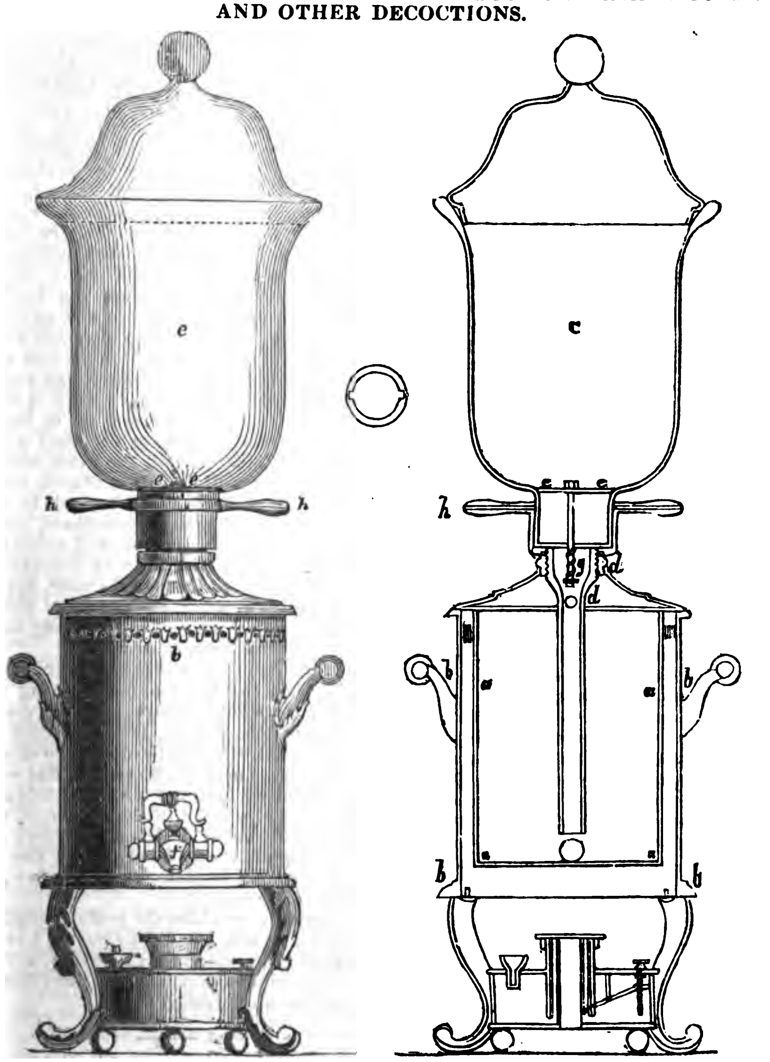
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 97, NEW SERIES.	SATURDAY, JUNE 20, 1840. PRICE ONE PENNY.	No. 218, OLD SERIES.

VARDY AND PLATOW'S PATENT APPARATUS FOR MAKING COFFEE AND OTHER DECOCTIONS.



City Press 1, Long Lane, Aldersgate Street: D. A. Doudney.

ton through its efforts to expand itself; while, on the other side, a vacuum is produced by the condensation of steam which has already performed its functions. The elastic force of the steam used in our marine engines is never great, and, without the aid of the vacuum, would be of but little effect in giving motion to the machinery; but it must be evident that, whatever may be the amount of that elastic force, it will act as an auxiliary to the power gained by means of the vacuum. Let us, in order to explain the advantage of working steam expansively, assume that it is admitted to the cylinder from the boiler, with an expansive force of thirty pounds on each square inch of surface. Such steam, when admitted into a space which allows of such an expansion, will enlarge itself to double its original volume, and will then have a force equal to the ordinary weight or pressure of the atmosphere. If, then, steam of thirty pounds' pressure be admitted within the cylinder, and the supply be stopped when the piston has performed half its course, the effect will be to exert a force during that half equal to its elastic power of thirty pounds, and then to exert a progressively decreasing force through its tendency to expand itself—until at the completion of the stroke, the volume of the steam will have been doubled, and its force thereby diminished to the ordinary pressure of the atmosphere. It must be understood that these numbers and proportions are used merely for exemplification; the steam is not often used at so high a density as two atmospheres (30 lbs. to the inch); nor is the supply to the cylinder always cut off at half the stroke, but sometimes at two-thirds or three-quarters; thus allowing the steam to expand through the remaining one-third or one-fourth only of the course of the piston. It will be evident, however, that by this means a considerable economy is produced in the quantity of steam expended, and that the gain will be equal to the power exerted by the steam admitted to the cylinder during the time in which it is expanding its volume, *minus* the cost of the greater weight of fuel required for generating steam of high elasticity, which increase bears only a small proportion to the power which is by such means accumulated. In the *Great Western*, the arrangement of the valves is such, that the supply of steam to the cylinders can be cut off at any part of the stroke, or the steam can be admitted during the whole of the stroke, at the pleasure of the engineer, and according to the varying conditions of the wind and weather.

COMBUSTION.

To the Editor of the Mechanic and Chemist.

SIR,—In your Number for 7th of March, there is an article on combustion, which contains a supposition of the practicability of obtaining incombustible wicks. There seems another consideration—the practicability of using them; for it strikes me, that an incombustible article could hardly support combustion for any length of time; if so (and a practical man can decide it), might not asbestos thread be obtained and used for the purpose? The only principle on which it might be counted on, would be capillary attraction. I have enclosed the form of the lamp I use, if you think fit to give it a place in your Magazine. W. H.

Ilfracombe.

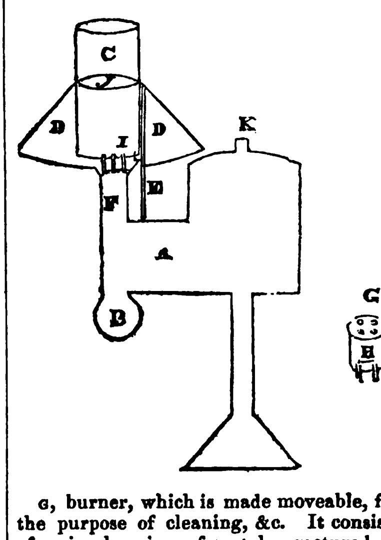
Description of Lamp.

A, thin communication between the body of the lamp and the tube, F. This tube is of a circular form.

B, receptacle for a coil of wicks, pushed down the burner.

C, the glass chimney, supported by the wire, E, with a crook at I, and a circle at J.

D, paper shade; this throws a very mellow light.



G, burner, which is made moveable, for the purpose of cleaning, &c. It consists of a circular piece of metal, punctured to receive four or more tubes; these are kept steady by a piece of tin, H, passed round them. I have burnt this in my bedroom (one wick only) for nine hours, without trimming or any attention whatever. I use what is called drawing cotton. It need

scarcely be remarked, that there must be a hole at K, to admit air.

[Amianthus or asbestos is employed for the wicks of the naptha and some other lamps—it is used in its natural state.—Ed.]

ON LATENT HEAT.

To the Editor of the Mechanic and Chemist.

Sir,—I scarcely expected my hurried and immature remarks on latent heat would have met with any notice from you. The superstitions or fictions of science appear in general to have arisen from the necessity there exists of giving a *name* to unknown causes. When first such name is given, it produces no evil effect; but when the name becomes familiar, we are naturally led to personify it; and, as we can generally predicate *part* of its nature, we are too apt to *attempt* to explain the whole of it, which whole is, in general, inexplicable in the present state of our mental progression. Again, we pursue no regular system in giving names to unknown causes. Perhaps it would be as well if the name of the effect, with some slight modification, was given to the unknown cause; as in the word "attraction," which is evidently given for something to be attracted or drawn to the cause: but no one imagines that this term contains the slightest clue to the nature of the cause, which is at present totally hidden from us. Now in the inquiry into the nature of heat, or rather caloric (for heat is the name of the known effect, and caloric of the unknown cause), the first question is, naturally, what are its effects? Every person is able immediately to enumerate some of these—such as, it decomposes organized bodies; destroys some chemical combinations, and promotes others; possesses the property of being radiated by some kinds of surfaces, and of being reflected by others. It is itself the effect of several chemical combinations; it causes water to expand into vapour, as, likewise, many hard bodies, including several of the metals, &c. When we have got a good catalogue of well-authenticated and carefully observed facts or effects of this unknown cause, we may then try to induce the nature of the cause, from observing in what particulars the effects agree. Now, at present, I apprehend, we do not possess anything like a sufficient number of data, to enable us even to approximate towards a reasonable idea of the nature of caloric. And, again, the data we do possess, I have never observed to be systematically arranged in any work I have yet seen.

From the data we now have—and on this foundation we can alone reason—I think we shall perceive at once, that caloric is not a matter properly so called, for this short reason—that it possesses not a single sensible property of matter; and when we consider that its principal effect is a separation or repulsion of the atoms (or, to speak positively, an expansion) of the volume of the body or matter which is affected by it, we shall find many reasons to liken it to electricity, which, by the way, is excited and made apparent by the self-same means that make caloric apparent, especially in its "latent state." May it not be probable, that light, heat, and electricity, are each of them peculiar phases, appearances, or developments of the same mysterious and all-pervading influence?

I offer these remarks thus discursively, in the hope that some of your talented correspondents may take the matter up. As I am very disadvantageously situated for following out such studies, you will be kind enough to excuse any inaccuracies or want of ratiocination in the preceding.

I am, Sir, yours, &c.

Tyro Botannicus.

CLEGG'S PATENT ATMOSPHERIC RAILROAD.

A scene of unusual animation and enjoyment displayed itself yesterday at Wormholt Scrubbs, about a mile to the right of Sheppard's Bush, in consequence of a notification rather widely, though privately made, that a portion of Clegg's atmospheric railroad, laid down on the Birmingham, Bristol, and Thames Junction line, would be opened at two o'clock for the inspection of those to whom its remarkable mechanism was an object of either general or particular interest. Long before the hour alluded to, many hundreds of persons were assembled on the "smooth green turf," by which the railway works are surrounded; some modestly wending their way on foot, while others, proud

"To turn and wind a fiery Pegasus,"

presented themselves on horseback; a chief portion, however, being conveyed in carriages of every class, and not unfrequently of the most superior construction. We are happy to state, that for speed, ease, and safety, no principle of locomotion has ever been more ingeniously planned, or more fully effected. The entire trip extended to the distance of half-a-mile, and was occasionally accomplished in eighty seconds, or at the rate of twenty miles an hour.

THE CHEMIST.

ON ALKALIES.

(Continued from page 48.)

MAGNESIA (Earthy).—An alkaline earth, first proved to be the oxide of a metal by Sir H. Davy; the metal he called magnesium; and 100 parts of magnesia consist of

Magnesium	60
Oxygen	40
	100

Magnesia is a fine, white, light powder, without either taste or smell. It requires 5150 parts of cold water, and no less than 36,000 of boiling water for its solution. Its specific gravity is 2.3. It is fusible only by the oxyhydrogen blowpipe or voltaic flame. It attracts carbonic acid from the atmosphere, but much more slowly than lime. Magnesia is generally procured by calcining the natural carbonate; but, to procure it pure, dissolve any quantity of the sulphate of magnesia (Epsom salts) in water, and add to the solution subcarbonate of potassa; double decomposition ensues; sulphate of potassa and subcarbonate of magnesia, which precipitate, are the result. Boil the precipitate with distilled water, to free it from adhering sulphate of potassa; dry it and expose it in a crucible to a bright-red heat; this drives off the carbonic acid, and leaves pure magnesia. The subcarbonate of magnesia, or magnesia alba of the apothecary, has been proposed by Mr. E. Davy to be added to damaged flour, to counteract its acescancy.

Morphia (Vegeto).—M. Robiquet employs the following process to obtain this alkali:—A concentrated solution of opium is boiled with a small quantity of magnesia (2½ drachms to a pound of opium) for a quarter of an hour; a greyish precipitate forms. The solution has then to be filtered, and the precipitate washed with cold water; after it is well dried, it is to be treated with weak alcohol, and allowed to macerate for some time with a heat under ebullition, by which a great quantity of colouring matter is taken up. The mass is again filtered and washed with cold alcohol; subsequently it is dissolved by a greater quantity of rectified alcohol, which is kept boiling, and, while in that state, is filtered once more. On cooling, the liquor deposits morphia. By the spontaneous evaporation of the alcoholic solution, it may be procured in regular crystals, which are transparent; these crystals are hydrate of morphia. If gently heated, they lose their water and become opaque. At a high temperature, they fuse into a yellow liquid. Morphia burns with a bright flame; it is soluble in 100 parts of boiling, and 40 of cold water. It requires 30 of anhydrous boiling alcohol for its solution; but is insoluble in ether. The average quantity of morphia obtained from opium, is about one ounce in a pound. In its anhydrous state, it consists of

Carbon	71.80
Hydrogen	6.34
Oxygen	16.90
Nitrogen	4.96
	100.00

Narceia (Vegeto) was discovered in 1832 by the celebrated chemist, Pelletier. The following was the process by which it was obtained:—An infusion of Turkey opium was filtered and carefully evaporated, till it left a solid extract, which, being redissolved in water, left a large portion of narcotina; this being separated, the liquid was heated to 212° Fahr., and a slight excess of ammonia added, to throw down morphia; after which, the ebullition was continued for ten minutes, to drive off the ammonia. On cooling, the remaining morphia was deposited. The residuary liquor was then reduced to half its bulk by evaporation, and baryta water was added to it, by which mecozate of baryta is formed; this is separated by filtration. Subcarbonate of ammonia was then added to throw down the remaining baryta. Heat was then applied to drive off any excess of the ammoniacal salt that might remain. The liquor was then filtered, evaporated to the consistence of syrup, and left for several days in a cool place, when it formed a pulpy mass, including crystals; this was suffered to drain, dried by strong pressure in linen, and then digested in boiling alcohol. The alcoholic solution, reduced to a small bulk by distillation, furnished, on cooling, a crystalline mass; this, purified by repeated solutions and crystallizations, is the subject in question. Pure narceia is soluble in 375 parts of cold, and in 230 of boiling water. It is soluble in alcohol, but not in ether. At a higher temperature than 220° Fahr., it is decomposed. It is also decomposed by strong acids; but when diluted, they dissolve and combine with it, producing at first a blue colour, which passes into purple, then red, and eventually disappears. According to the analysis of M. Pelletier, it is composed of

Carbon	54.73
Hydrogen	6.52
Oxygen	34.42
Nitrogen	4.33
	100.00

Narcotina (Vegeto).—The alkaline characters of this substance are not very distinct; but its ultimate composition, and its combining with acids, places it among them. Narcotina may be obtained by making an ethereal tincture of opium, by which only the caoutchouc and the narcotina are taken up. It must subsequently be purified by solution in, and evaporation of alcohol: it is then obtained in well-defined crystals, which are slightly soluble in hot, but insoluble in cold water. It combines with acids, more especially the hydrochloric. From its strong exciting powers, if taken into the stomach alone, it causes an unnatural brilliancy of the eyes, contraction of the pupils, and giddiness. According to the last analysis of M. Pelletier, it consists of

Carbon	65.16
Hydrogen	5.45
Nitrogen	4.31
Oxygen	25.08
	100.00

S. Piesse.

CHARCOAL.

To the Editor of the Mechanic and Chemist.

Sir,—The following table contains the result of some experiments made by Mr. Mushet, on the quantity of charcoal afforded by different woods:—

100 parts of	Lignum Vitæ yield	26.8
	Mahogany	25.4
	Laburnum	24.5
	Chestnut	23.2
	Oak	22.6
	American Black Beech	21.4
	Walnut	20.6
	Holly	19.9
	Beech	19.9
	American Maple	19.9
	Elm	19.5
	Norway Pine	19.2
	Sallow	18.4
	Ash	17.9
	Birch	17.4
	Scottish Fir	16.4

S. Piesse.

MISCELLANEA.

Hints for Workmen.—The faults of well-paid workmen are not deficient industry, but excessive, or, at least, irregular exertion. Excessive application during one part of the week, is frequently the cause of idleness complained of during the remainder. Great labour, either of mind or body, continued for several days together, is, in most men, naturally followed by a great desire for relaxation, which, if not restrained by force, or some strong necessity, is almost irresistible. It is the call of nature, which requires to be relieved by some indulgence or change of occupation. Relaxation does not always imply idleness, but " easing the wearied part," by exchange of employment. If not complied with, the consequences are often dangerous and sometimes fatal; and such as almost always bring on, sooner or later, the infirmity of the trade. If masters would be more humane, and journeymen more reasonable, both would see the utility of temperate exertions of industry. The man who works so moderately as to be able to work constantly, not only preserves his health the longest, but, in the course of the year, executes the greatest quantity of work. Labour, without reasonable intervals of rest for meals and relaxation, exhausts the energies of both body and mind, and is, of the two, more hurtful than low wages, which abridge diet and physical comforts.

Price of Labour.—As the high price of labour produced by scarcity of workmen, is the fortress that protects all their comforts and inconveniences, they ought never to yield an inch of the " vantage ground" without dire necessity. The example of such individuals, or bodies of individuals, as submit quietly to have their wages reduced, and who are content if they get only the mere necessaries of life, ought never to be held up for public imitation. On the contrary, everything should be done to make such apathy esteemed disgraceful. The best interests of society require that the rate of wages should be elevated as high as possible—that a taste for the comforts, luxuries, and enjoyments of life, should be widely diffused, and, if possible, interwoven with national habits and prejudices. Very low wages, by rendering it impossible for any increased exertions to obtain any considerable increase of comforts and enjoyments, effectually hinders them from being made, and is, of all others, the most powerful cause of that idleness and apathy, that contents itself with what can barely continue animal existence. Is the improvement in the circumstances of the lower ranks of the people to be regarded as an advantage, or as an inconvenience to society? The answer seems at first abundantly plain. Servants, labourers, and workmen of different kinds, make up the far greater part of every great political society. But what improves the circumstances of the greater part, can never be regarded as an inconvenience to the whole. No society can surely be flourishing and happy, of which the far greater part of the members are poor and miserable. It is but equity, besides, that they who feed, clothe, and lodge the whole body of the people, should have such a share of the produce of their own labour, as to be themselves to-

lerably well fed, clothed, and lodged. Government is interested not less than the people in the diffusion of such sentiments. Government cannot be rich, while the body of the community is indigent; it cannot be safe, while that on which it mainly rests cannot be depended on for support. It is not the opulent who demand legislative attention; they are exempt from want, and, as they assume to be educated, they ought to be exempt from crime; they form that part of the social waste which has been reclaimed and cultivated: but the poor, if not still in the wilderness, are only on its verge, and require to be brought forward by the application of those practical truths I have endeavoured to explain and enforce.—*History of the Middle and Working Classes.*

Whirlpools.—Two currents of equal force, but of different directions, meeting in a narrow passage or gut, will cause what is generally called a whirlpool, and has ignorantly been said to be produced by subterranean rivers, gulfs, chasms, &c.; but essentially is only an eddy, produced by the contact of two currents, which, as if meeting on a centre, whirl round, as it were, in each other's arms. The whirlpool named the Euripides, near the coast of Greece, alternately absorbs and rejects the water seven times in twenty-four hours. Charybdis, in the Straits of Sicily, absorbs and rejects the water three times in twenty-four hours; and the Maelstrom, on the coast of Norway, which is considerably the largest, absorbs, every six hours, water, ships, whales—in short, everything that approaches its malignant influence, and the next six hours is employed in casting them up again. These eddies are sometimes augmented by the force of contending tides, or by the action of the winds. They draw vessels along, dash them upon rocks, or engulf them in their furious vortices, the wreck not appearing until some time after.

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, July 25, William Basham, Esq., M.D., on the Comparative Physiology of Respiration. At half-past eight.

Poplar Institution, East India Road.—Tuesday, June 23, W. Gibbins, Esq., on Astronomy. At eight o'clock precisely.

QUERIES.

1. A receipt for making caoutchoucine, or India-rubber court plaister? 2. How to make the paste for fixing paper hangings to walls, and directions for performing the work? 3. A receipt for making the best kind of plate powder? 4. Which would be the quickest and easiest way to kill oak, ash, or elm-timber trees; as I am informed that, if the trees were killed and left standing for some time afterwards, the timber would be of a much superior quality for many uses? 5. Is there a preparation made and sold by chemists or druggists, from a plant called catananch coerulea; and if so, what are its uses and effects (if taken internally) on the human constitution? 6. I wish to be informed of the best and cheapest work on algebra. 7. The newest and most approved work on analyzing soils of all kinds, and also for fertilizing all kinds of inferior and barren soils? N. M. T.

What are the best kind of boilers now in use for condensing engines; and in what does their superiority chiefly consist? Y. E.

A description of the Cornish expansion engine, its mode of operation, and whether the principle is likely to be generally adopted; and if so, what would the result be, as it regards the expense of erection, the cost of fuel, &c.? Would it eventually supersede the common condensing double-power engines now working? Is it adapted for drawing coals, and would it answer all the purposes for which steam-engines are required at a colliery. YOUNG ENGINEER.

A description of Professor Mascati's anemoscope, and also that of Cavalier Marsilio Landriani's, having, some time back, invented an instrument for the same purpose? I have submitted it to the opinions of several scientific gentlemen, and they think a good instrument of that kind is very desirable for meteorological observations, &c. C. A. BOWDLER.

What is oil of Behn, and what made from? .... B. MOUNTFORT.

The proper method of gilding letters, figures, &c., on glass? .... THOMAS LEE.

The cheapest and best way in which pyroligneous acid is obtained, to make a quantity at once? T. F. B.

ANSWER TO QUERIESS.

To Prepare Phosphuretted Ether.—Let sulphuric, that is, common ether, stand over a quantity of phosphorus in a well-stopped vial for several weeks. The solution is aided by occasional agitation. Ether dissolves but a very small quantity of phosphorus; but the solution is so strong, that if a bottle containing it is opened in the dark, there is sufficient light to see the time on a match. B. MOUNTFORT.

TO CORRESPONDENTS.

J. C. L.—*We will endeavour to obtain the information he desires.*

A Constant Reader.—*We shall be happy upon all occasions to promote the cause of popular instruction and our correspondent's suggestions shall not be lost sight of.*

Epictetus *will find the process of fixing photogenic drawing on paper, in No. 38, N. S., of the "Mechanic."*

ERRATUM.—Page 14, line 16, Vol. VI. No. 2, for "Dahuria" read *Daturia.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

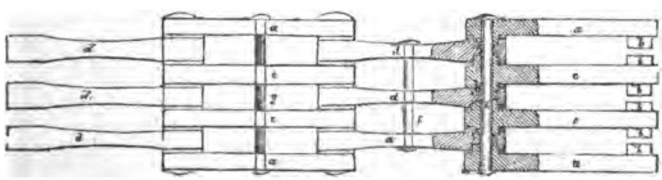
MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 98, NEW SERIES.	SATURDAY, JUNE 27, 1840. PRICE ONE PENNY.	No. 219, OLD SERIES.

CUTLER'S PATENT FOR CONSTRUCTING CHAINS.

Fig. 1.



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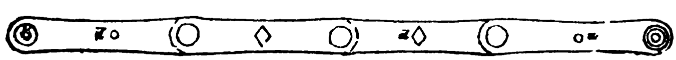

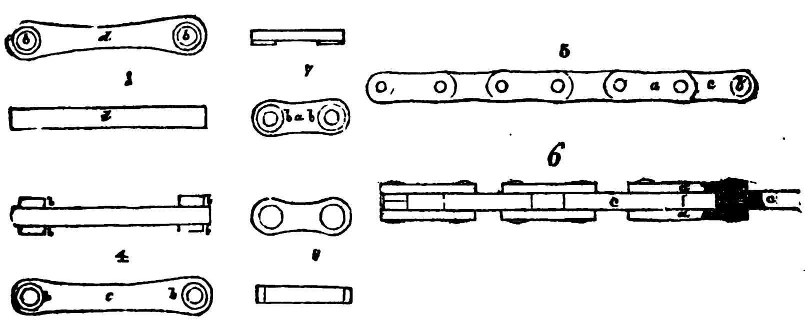

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CUTLER'S IMPROVED METHOD OF CONSTRUCTING CHAINS, &c.

(*Abstract of Specification.*)

My invention relates, first, to certain novel constructions of wrought-iron chains, wherein the parts are so formed and combined, as to offer greater security; and chains so constructed are less liable to fracture and derangement, than the various wrought and other iron chains heretofore constructed.

Secondly, the invention relates to the means of forming the links, bars, and bolts, of such novel construction of chains. And in order to give the best information in my power, I will proceed to describe the engraving (see front page), in which the same letters of reference are used to indicate similar parts wherever they occur.

Description of the Drawing.

Fig. 1 represents a plan of part of a chain constructed and combined according to my invention.

Fig. 2 is an edge view of fig. 1; and

Figs. 3 and 4 show separate parts of such chain. The principle on which this chain is constructed is such, that one set of bars, links, or bolts, have circular, by preference cylindrical, projections formed thereon; and the other set of bars, links, or bolts, have corresponding circular, and by preference cylindrical, sockets or cavities formed therein; so that when a projection of one bar enters a socket or cavity of another bar, the one shall correctly fit the other, yet allow of the projection turning in the socket or cavity; and, in addition to such sockets and projections, there are to be holes formed through the bars, passing through the centre of each cylindrical projection, and also through the cavities or sockets, through which a pin is passed; hence, when any number of pairs of links, bars, or bolts, are combined together, they will each and all be capable of movement on the pin; and, farther, each bar or link with a socket will be capable of movement on circular projections, and the bars or links, with projections, will be capable of movement in their respective sockets, all which will readily be understood on a careful examination of the drawing, aided by the following explanation thereof:—*a a* represents the outside bars, links, or bolts of the chain; they have each hollow cylindrical projections, *b b*, as is already shown in the drawing; *c c* are the minor links, bars, or bolts, which have each four cylindrical projections, *b*, two at each end, but on opposite sides of the bars; *d d d* are links, bolts, or bars, each having four cylindrical cavities or sockets, b^1, to receive the projections, *b*, of the bars, *a a*. It will be seen that there are four bars, bolts, or links, *a c*, to three of the links, bolts, or bars, *d*; consequently, in order to make all parts of the chain equally strong, or as nearly so as possible, the three bolts, bars, or links, *d*, should be each somewhat stronger than a bar, bolt, or link, *a c*. The two sets of bars, bolts, or links, are combined together by means of the wrought-iron pin, *e*, which is passed through the holes formed through the centres of the cylindric projections, and through the holes in the sockets. The pins, *e*, may be fastened by rivetting, or by having a head at one end, and screw and nut at the other; *f g* are pins which pass through the links, bars, or bolts, *a c* and *d*, by which the parts are more closely combined, and offer a means of holding the chain together, even though a pin, *e*, should be broken or fall out; for it will be evident that the sockets and projections, being retained together by the pins, *f g*, the chain would work safely; but I consider the pins, *e*, should at all times be employed, though the pins, *f* and *g*, may be dispensed with when desired, and, when used, they may be rivetted, or have screws or nuts, as shown.

Fig. 5 shows a plan; and

Fig. 6, an edge-view of chains constructed according to another part of my invention, differing in some respects from that already described.

Fig. 7 and fig. 8 show separate views of the two descriptions of bars, links, or bolts employed. In this case there is one class of bolts, bars, or links, which have cylindrical projections, similar to those already described; the other bars, links, or bolts, having holes formed through them of the same form as the projections, in place of having recesses, consequently two bars with projections being laid together, having another bar, *d*, with holes through it (of the required size), the projections may be said to act as an axis to the other or intermediate bolt, bar, or link, *d*, on which the same may turn freely. In this case I have only shown two bars, *a a*, to one bar, *d*; but it will be evident, that by forming some of the bars, *a*, like the bars, *c*, of the former chain, that is, having four projections, *b*, on each, a wide chain may be made according to the purpose to which it is to be applied; and it will be evident, that by combining the links, bars, or bolts, *a a*, in pairs with one link, *d*, to each pair, a chain may be made only half the width of fig. 1; and farther, by using more of the

links, bars, or bolts, *c* and *d*, wider chains may be made than those shown at fig. 1.

I would remark, that the chain shown at fig. 1, is suitable for pit-chains, cables, and suspension-bridges, the only difference being, that in making chains for suspension-bridges, the links, bolts, or bars, must be longer and stronger in proportion to their increased size; and the chain, fig. 5, is suitable for driving machinery, or other purposes; my invention only relating to the modes of forming the junctions of the links, bolts, or bars, for whatever purpose they may be applied. I have not thought it necessary to show many different lengths of links or bars, and they will necessarily be varied according to the purpose to which they are to be applied; as will also their figure or shape, while the modes of connexion will remain the same. It is important that the various parts of such chains should be made with care and with considerable accuracy, in order that one link, bar, or bolt, should not have to bear more strain than another, and that the sockets and projections should accurately fit, allowing, however, of the same turning with freedom. And, in order to accomplish such accuracy of the parts, I have invented suitable dies for stamping the bars, links, or bolts, *a c d*. For making the bars, *a*, I have two dies fitting accurately together, and having projecting studs and holes to receive them; whereby the two dies are at all times insured going accurately together. In one such die is formed a recess of the figure of the bar, link, or bolt, *a*, and of such a depth as to receive about half the thickness of such a link, *a*. The other die is similarly sunk to the first; but, in addition thereto, there are two recesses therein, equal to forming or shaping the projections, *b*, with a nipple or stud in the centre, for the purpose of piercing the necessary hole for the pin to pass through; but if such hole should not be pierced entirely through by stamping, the piercing may be perfected by the means of a pair of piercing tools in a press; and, in forming the bars, *c*, two dies, such as the one last described, are to be used, in order to form or shape the projections, *b*, on each side of the bars, links, or bolts, *c*, with nipples or studs therein, to pierce the hole for the pins to pass through, as before described. In making the bars, bolts, or links, *d*, the dies are to be the reverse of those for producing the projections, *b*, such dies having projections formed therein to produce the sockets.

I would remark, that I am aware that the links, bolts, or bars, of ordinary chains have been before made by stamping them in dies; I do not, therefore, claim the use of dies for such purposes generally, but my invention only relates to the improved mode of constructing dies suitable for shaping projections, *b*, and for producing cavities or sockets, b^1, as herein explained. In forming the bolts, bars, or links, previously to stamping, I either forge the same into as nearly the figure desired as possible by hand, or cut them out of thick sheet-iron, by means of a pair of tools worked in a press; or else I have bars rolled, leaving projections or recesses (as the case may be) at suitable intervals, and each link being heated to a bright-red heat, it is inserted into its proper dies; and by pressure or by blows, the same are caused to close and produce the figure of link, bolt, or bar desired; after which the projections, *b*, and the cavities, are to be finished in the lathe by means of suitable tools.

NELSON'S IMPROVED METHODS OF PREPARING GELATINE, &c.

As this process throws much light upon the nature of glue, size, and eatable jelly or gelatine, we give the patentee's account, with no farther abridgment than the omission of the passages relating only to the chicanery of the law.

"My invention consists in using or applying to the glue pieces which I use, a caustic-alkaline solution, either with or without acid or acids (not being sulphurous acid in a liquid state), without such solution for preparing gelatine, which has the properties of, or resembles glue. Before I apply my invention, the glue-pieces which I use must be freed from hair or wool, and flesh and fat, and then washed clean in cold water; and when I make the gelatine, which I call my gelatine of the first quality, I prefer to use the cuttings of the hides of beasts or of the skins of calves.

I shall first describe the method by which I prepare the gelatine, which I call my gelatine of the first quality; and for the purpose of reference, I designate this method the first operation. I have already stated, that when I make this gelatine, I prefer to use the cuttings of the hides of beasts or of the skins of calves. When the cuttings have been freed from hair, flesh, and fat, and washed clean in cold water, I score the grain side of them to the depth of about an eighth part of an inch, in lines about an inch apart, in order to facilitate the action of the alkali which I use, and to render such action more uniform. I then macerate them in

a caustic solution of alkali, at a temperature of about 60° of Fahrenheit, using for this purpose brick vats or vessels, lined with cement in the ordinary manner; and these vats or vessels, which I call the macerating vessels, must be covered with lids excluding the general atmosphere; any vessels which are not acted upon by the alkali may be used. I thus macerate the cuttings until I can pass a fork or any other similar instrument through them with little resistance, and I generally find that they are sufficiently macerated in about ten days. The alkali which I prefer for my solution is soda, and I prepare my solution in the ordinary method, using three parts of the common soda of commerce, with two parts of fresh-burnt lime to sixteen parts water; or any quantity of fresh-burnt lime, sufficient to render the solution caustic, may be used. When the process of maceration is sufficiently complete, as already pointed out, I remove the cuttings from the solution, and put them into vessels similar to the macerating vessels, and which must also be covered with lids, excluding the general atmosphere; and I leave them in such vessels thus covered until they have become sufficiently soft. It will be ascertained whether they have become sufficiently soft, by passing a fork or other similar instrument through them; and when they have become sufficiently soft, the flock or other instrument will pass easily through them. While the cuttings are thus left to become soft, they must be kept at a temperature between 60° and 70° of Fahrenheit; and, as they become sufficiently soft, as above pointed out, I remove them, and I slice or split such of the cuttings as are materially thicker than the others, in order to bring them to the same or nearly the same thickness. I then put the cuttings into wooden cylinders placed in water-vessels, filled with clean cold water; but care must be taken not to put into any cylinder more than half the quantity which it is capable of containing. These cylinders, which I call washing cylinders, must be constructed in such manner as to allow water to pass freely through them, and they may be fitted in the water-vessels in any convenient manner, to allow of their revolving within such vessels. I secure the cuttings within these cylinders, and then I cause the cylinders to revolve slowly in the water. I have found cylinders of three feet in diameter a convenient size, and I cause these to revolve at a speed of about one revolution in a minute. While the washing cylinders are thus revolving, I cause a current of water to be kept up through each of the water-vessels, by means of an aperture at the bottom of the vessel at one end, and a pipe at the top at the opposite end, through which pipe clean cold water is continually supplied. I continue the cylinders revolving in a current of water, as I have described, until the alkali is sufficiently washed out of the cuttings; and I generally find six or seven days sufficient for this washing, when I use cuttings of ordinary thickness; but when I use cuttings which are thicker than these, I continue the washing in proportion to the thickness of such cuttings. When the cuttings have been thus washed, I remove them from the washing cylinders, and place them in a wooden closet, constructed in the ordinary method, to prevent the escape of gas, and there expose them to the direct action of sulphurous-acid gas, produced by the combustion of sulphur within the closet. I continue the cuttings thus exposed to the direct action of this gas, until they have a slight excess of acid; and I ascertain whether they have an excess of acid, by testing them with litmus paper in the ordinary manner. I then remove them from the closet, and press them by any ordinary means, to separate as much water as possible; and, after they have been thus pressed, I put them into glazed earthenware vessels, or any other vessels which are not acted upon by acid. I call these vessels steam-baths, and I apply steam to them in the manner usually employed for heating steam-baths; but any other convenient means of heating them may be used; I thus bring the cuttings to a temperature of about 150° of Fahrenheit, and I keep them at this temperature, and by means of a suitable wooden instrument, I stir or agitate them until they are almost entirely dissolved. The liquid thus formed is gelatine, and I separate it from the residuum which remains undissolved, by straining, and put it into vessels, which I call settling vessels, and which are constructed in the same manner as the steam-baths. I heat these settling vessels in the manner which I have already pointed out for heating the steam-baths. While this liquid gelatine is in these settling vessels, it should be kept at a temperature between 100° and 120° of Fahrenheit, and I allow it to remain undisturbed in the settling vessels, for the purpose of clearing it, until I consider that the impurities which it contains have sufficiently settled or subsided; I generally find nine hours sufficient for this purpose; but if the impurities have not sufficiently settled or subsided in that time, I prefer to clear it

by straining it through a woollen cloth. I remove the liquid gelatine from the settling vessels by means of a syphon; but any other suitable means may be used for this purpose, and after it has been sufficiently cleared I pour it upon slabs, which I call cooling slabs, to the depth of about half-an-inch. These slabs may be of stone or slate or marble; but they must have frames of some convenient material, at least half-an-inch in depth, fitted to their edges, and care should be taken to place the slabs in cool situations. I allow this gelatine to remain upon the slabs until it becomes cold, and sets into a firm substance; and I then cut it into pieces, and wash these in the washing cylinders and water-vessels, which I have already described for that purpose in respect to the cutting, as I take them from the macerating vessels. This washing must be continued until the excess of acid is entirely, or nearly altogether removed from the gelatine, and I generally find that three days are sufficient for this purpose; but I ascertain whether the excess of acid has been removed, by testing the gelatine with litmus paper in the ordinary manner. After the excess of acid has been thus removed, I take the gelatine from the cylinders and put it into the steam-baths, and then dissolve it, by applying heat to the baths in the manner which I have already pointed out for that purpose; but it will be desirable to avoid raising the temperature of the gelatine above 85° of Fahrenheit. When the gelatine has been thus completely dissolved, I pour it again upon the cooling slabs, as before, and I allow it to remain until it becomes again cold, and sets into a firm substance. I then cut it into pieces of any convenient size, and dry it upon nets by exposure to a current of cool dry air; and when it has been thus completely dried, it is fit for use.

In the operation which I have described, I have stated that a residuum of the cuttings remains undissolved. This undissolved residuum may be used in the manner which I have hereinafter mentioned for that purpose.

I call the gelatine which I obtain by the operation already described, my gelatine of the first quality; but equally good gelatine may be obtained from the cuttings of the hides of beasts, and of the skins of calves, by the use or application of alkali, without using or applying acid to such cuttings; and I shall now describe the method which I employ for this purpose, and for the purpose of reference, I designate this method the second operation. I treat the cuttings in the manner which I have described in the first operation, until they have been washed and taken from the washing cylinders, and I then press them, by any ordinary means, to separate as much water as possible; and, after they have been thus pressed, I put them into the vessels which I call steam-baths, and heat these vessels by applying steam in the usual way for that purpose, until the cuttings attain a temperature of 120° of Fahrenheit; but any other convenient means of heating these vessels may be used. I keep the cuttings at this temperature, and stir or agitate them by any ordinary means for about four hours. The cuttings will thus be partially dissolved, but in a smaller proportion than by the first operation. The liquid thus formed is gelatine, and I separate it from the residuum, which remains undissolved, by straining, and put it into the settling vessels. I heat these vessels in the manner which I have already pointed out for that purpose; and while this liquid remains in these vessels, it should be kept at a temperature of 100° of Fahr. I allow the gelatine to remain undisturbed in these vessels, until the impurities which it contains have sufficiently settled or subsided. I generally find six hours sufficient, but it may be allowed to remain longer if considered desirable. After it has been thus cleared, I remove the liquid gelatine from the settling vessels, in the manner which I have already described for that purpose, and pour it upon the cooling slabs to the depth of about half-an-inch, and I allow it to remain upon these slabs until it becomes cold, and sets into a firm substance; I then cut it into pieces of a convenient size, and dry it upon nets, by exposure to a current of cool dry air; and, when it has been thus completely dried, it is fit for use."

(*To be continued.*)

SPECIFICATION OF BOGARDUS'S PATENT

FOR IMPROVED MEANS OF APPLYING LABELS, STAMPS, OR MARKS TO LETTERS, &c.

To all to whom these presents shall come, &c. &c.—Now know ye, that in compliance with the said proviso, I, the said James Bogardus, do hereby declare, that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained, in and by the following statement thereof; that is to say:—

The object of my invention is, to annex

a stamped or engraved label to a letter or other document, by means of the seal, thus avoiding the use of adhesive or gummed labels.

The label, whether of paper or parchment, may be of any size or shape; and if it be required to affix one to a letter by means of a wafer, let the wafer cover a portion of the label, and the rest of the wafer will seal the letter; the same may be done with wax.

But a better method is, to cut or pierce a hole in the label, which hole, being placed where the wafer or wax is placed to seal the letter, the act of sealing the letter affixes the label, and this method may be applied to any document whatever. In witness whereof, &c.

Enrolled February 26, 1840.

USE OF GOLD LEAF IN THE SMALL-POX.

The discussions which are now proceeding in the House of Commons, and the investigations which have been instituted for the purpose of ascertaining the effect of variolous innoculation, have brought to light numerous facts, which show that the ravages of that dreadful disease, the small-pox, are, notwithstanding the progress of medical science, still felt to a fearful extent, especially among the poorer classes. In cases where the disease has been induced by innoculation, it has been found so intense and virulent, that when death has not ensued, it has most frequently left ineffaceable traces of its presence, and disfigured the features by scars which remain till the end of life. Two years ago, M. Larrey, in a note read to the French Academy, said that the Egyptians and Arabs preserved the faces of young persons from the disorganizing action of the small-pox, by covering them with gold leaf at the moment of the attack of the malady. At a recent meeting of the same learned body, Dr. Legrand announced that he had tried, with complete success, the application of this method to a young female, attacked by a confluent small-pox. From the first instant of the eruption to the end of the fever of superation, he covered, night and morning, the whole face with leaves of fine gold, such as are used for gilding; and he caused them to adhere by applying a little gum water. With the exception of some places on the side, where the gilding was rubbed off by contact with the pillow; the face, although it had undergone a great tumification, was perfectly preserved, and the features retained all their delicacy. The hands, which had not been submitted to the same preservative process, presented some characteristic marks. Surely, after this favourable report from so respectable an authority, the medical profession of this country will not reject so innocent a mode of treatment without a fair trial.

THE CHEMIST.

CHEMICAL ANALYSIS.

(Continued from page 300.)

CHARACTERS OF GASES.

The three principal gases—oxygen, hydrogen, and carbonic acid, having already been described, with the means used for detecting their quantity when mixed with other gases; I now deem it almost necessary to give a description of the principal characters of gases—as their colour, whether inflammable or non-inflammable, absorption by water, &c.; as a means of lessening, in a great measure, the trouble attending on gaseous analysis.

1. Protoxide and deutoxide of chlorine are of a yellowish-green colour; nitrous acid, red.

2. The gases destitute of smell, are oxygen, hydrogen, nitrogen, protoxide of nitrogen, carbonic acid, and carburetted hydrogen, when extremely pure.

3. Those that are inflammable in open air when lighted, are hydrogen and its carburets and phosphurets, potassuretted hydrogen, sulphuretted, telluretted, and arsenuretted hydrogen, cyanogen, and carbonous oxide.

4. Those, if into which a recently extinguished taper be introduced, are the cause of its rekindling, they are oxygen, protoxide of nitrogen, nitrous acid, and the oxides of chlorine.

5. Alkaline gases—ammonia and potassuretted hydrogen.

6. Acid gases, which redden infusion of litmus or blue gilliflowers; such are the oxides of chlorine, cyanogen, sulphuretted and telluretted hydrogen, fluoboric, muriatic, hydriodic, sulphurous, chlorocarbonic, carbonic, nitrous, and fluosilicic acids.

7. Soluble in alkaline solutions; such are the oxides of chlorine, sulphuretted and telluretted hydrogen, ammonia, and the hydriodic, fluosilicic, chloric, carbonic, chlorocarbonic, nitrous, muriatic, sulphurous, and fluoboric acids.

8. Soluble in one-thirtieth its volume of water; such are the muriatic, nitrous, sulphurous, fluosilicic, and fluoboric acids, and ammonia.

. Producing white vapour in the air—fluoboric, fluosilicic, hydriodic, and muriatic acids.

Peculiar Characteristics of the different Gases.

(Specific gravity of air taken as 1.00.)

1. *Oxygen*, sp. gr. 1.1111; weight of 100 cubic inches 33.888 gr. heavier than atmospheric air; absorbed by water in a small degree, inflammatory, and detonates with hydrogen.

2. *Hydrogen*, when freed from water, sp. gr. 0.0694; at 60° Fahr., and 30° in barom. press.; 100 cubic inches weigh 2.118 gr.; colourless, garlic odour, combustible, flame yellowish, white colour, with a reddish tinge, and extinguishes animal life by inspiration; is fired by spongy palladium or platinum.

3. *Nitrogen* or *Azote*, sp. gr. 0.9722; 100 cubic inches weigh 29.65 grs.; extinguishes flame and animal life; destitute of smell or taste; yields ammonia by ignition in a glass tube.

4. *Carbon*, sp. gr. 0.4166; 100 cubic inches weigh 12.708 grs.

5. *Cyanogen*, sp. gr. 1.8064; 100 cubic inches weigh 55.1295 grs.; penetrating smell, inflammable, colour of flame blue. Water at 60° absorbs 4½ times its volume, and acquires a sharp taste. Pure alcohol absorbs 23 times its volume, reddens litmus (but the colour is restored by heat), and deprives of colour the red sulphate of manganese.

MANIPULATOR.

MISCELLANEA.

Beautiful Metallic Crystals.—Over one ounce of iron filings in a tea-cup, pour a table-spoonful of sulphuric acid, diluted with four times its quantity of water; boil it for a short time, and set it aside to cool, when beautiful crystals of sulphate of iron will be formed. E. L.

To give a Person a Supernatural Appearance.—Put one part of phosphorus into six of olive oil, and digest them in a sand heat. Rub this on the face, and the appearance in the dark will be supernaturally frightful.

Diminution of the Sun's Light.—It has been calculated that the sun's light, when he is at the horizon, is diminished 1300 times before it reaches the surface of the earth, by reason of the great column of air which it has to traverse.

P. A.

[This is a mistake; the phenomenon is explained by the *impurity* of the vapours near the surface of the earth, not their *extent*, and the dispersion of the rays by refraction.—ED.]

Machinery enters into competition with human labour; and, therefore, there are some people who say, let us tax machinery to support the labour which it supersedes. The real meaning of this is—let us tax machinery to prevent cheapness of production, to discourage invention, and to interfere with a change from one mode of labour to another mode. There are temporary inconveniences, doubtless, in machinery; but every man who suffers from these inconveniences, possesses in himself the power of remedying those evils, or, at least, of mitigating them. But any proposed remedy for a temporary evil, which has a tendency to arrest the course of improvement, is a little like the ancient wisdom of the Dutch market woman, who, when the one pannier of her ass is too heavily laden with cabbages, puts a stone into the other pannier to make matters equal.—*Working Man's Companion.*

Coffee.—The first mention of coffee in the west of Europe is by Ramsoff, a German traveller, who returned from Syria in 1573. It was first brought into England by Mr. Nathaniel Conopius, a Cretan, who made it his common beverage, at Baliol College, Oxford, in 1641. Coffee trees were conveyed from Mocha to Holland in 1627, and carried to the West Indies in the year 1726; first cultivated at Surinam by the Dutch in 1718, and its culture encouraged in the plantations in 1732.

A Wild Cat, of the following extraordinary dimensions, was caught on the farm of Kilnford, parish of Dundonal, on Tuesday, the 19th of May, 1840—viz., from the snout to the tip of the tail, along the back, 2 ft. 11½ in.; from the above extremities, over the fore and hinder feet (as in running), 4 ft.; height at shoulder, 14½ inches. Although burdened with a heavy rabbit stamp, in which it was caught, the courageous grimalkin faced about several times, and seemed determined to sell his life at the dearest rate; and it was with no little trouble that he was at last secured.

I. S. D.

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, July 2, John Fisher Murray, Esq., on the Writings and Genius of Homer. At half-past eight.

Poplar Institution, East India Road.—Tuesday, June 30, J. Bateman, Esq., on Acoustics. At eight o'clock precisely.

QUERIES.

I have tried to render cloth water-proof, as stated by your correspondent, "E. J. S." of No. 35 of your Journal, but have failed. Perhaps that correspondent will be so kind as to say how it is to be applied, as I suppose I have not used it right? J. S. D.

Sir, I should consider it a very great favour if I could be instructed, through the medium of your publication, the best mode of heating a room 60 feet × 40 feet, to a temperature of 200°. Coal only is intended to be employed in generating the heat; and it is very desirable that it should be uniform throughout the whole extent of

the room. Perhaps I ought to observe, that the fire or fires must be placed at the outside of the room, and the flues conducted underneath the floor; and it is the method of such fluing that I wish to be informed of. If, however, any better mode of disposing the flues could be suggested, so as to produce the above temperature, I shall be happy to have an explanation of it.

SHERWOOD.

[To obtain so high a temperature, the flues must be numerous, and ought to intersect the apartment in different places; but their disposition must of course be regulated by the space that can be spared. Steam is, beyond comparison, superior to any other medium for distributing heat to a great distance. If our correspondent had stated for what purpose this great heat was required, or, at least, what portions of the apartment might be destined for the flues, the solution of his problem would have been much facilitated; and it would also have been proper to have mentioned the height of the room. With these suggestions, we leave the subject as an "open question" for the consideration of our numerous and enlightened readers.—ED.]

The principle of the "Manifold Writer," and wherein it differs from the copying machine? Also how I might construct a manifold writer; for I believe that is the most simple?

J. K. A.

How to clean globes? C. R.

1. How to take ink stains out of paper? 2. How to clean white kid gloves? 3. How to take grease stains out of paper? G. F. GIBBS.

1. How to purify quicksilver? 2. How to make a wheel barometer? 3. How to make yellow brass? 4. How to make hard solder for brass and copper? 5. How to tin brass and copper? 6. How to make the metal that spoons are made of called tooth-and-egg? 7. How to make sulphuretted hydrogen? E. L.

The process of blowing joints to pewter pipe, what the solder consists of, how to make the same, and where I can purchase a proper blow-pipe for the occasion? Also, if there is a means of tining cast and wrought-iron pipe without the application of heat? I have been given to understand, that it can be done; if so, I shall feel much obliged if any of your correspondents can inform me of the process, and what I shall require for the process, and whether it would answer to solder lead pipe to it, for instance? Also the method of polishing the horns of the buffalo, such as I have seen on chimney-pieces, and the cheapest and best place to get them mounted with silver?

J. D.

By experience I have found, that all vegetable oils are, from the gums and acids they contain, quick in clogging in machinery, and also, from that circumstance, are unfit for many other uses. Trotter oil being an animal one, and, when purified, would be very good for my purpose, if some of your correspondents could let me know where some is kept pure in store? Q. M.

How to make the varnish used for paper, such as cards, &c.? P. T.

ANSWERS TO QUERIES.

In answer to a "Y. E.'s" inquiries respecting the best kind of boilers for condensing engines, I beg to state, that the cylindrical or tubular boilers are best; and their superiority consists in the greater strain they will bear, the convenience of their form, and the great extent of flue surface, which not only raises the steam quicker, but keeps it generated at about one-third of the supply of fuel used to other boilers. But this superiority will not appear, if the boiler be not covered to prevent radiation of heat: they are best covered with saw-dust or cinder-ashes, to the depth of twelve inches. Engineers are not generally aware of the saving, by adopting means to prevent radiation; they may have been told of it—they may have read, but they must see it ere they will sufficiently open their eyes to its importance; and let any one try it—let him enclose his boilers, his steam-pipes, and his cylinder, pretty thickly, with any non-conducting substance (saw-dust or cinder-ashes are best), and he will find, where he spent 100*l.* for fuel, he will now spend but 30*l.* or 40*l.*; he must also so set his boiler, that if it have 500 feet of surface, he shall have 350 feet to be acted upon by the fire; or this would be the extent of flue surface, supposing the surface of the whole boiler was 500 feet. These are facts deduced from experience, and not built on any plausible theory.

The Cornish expansion engine works on the well-known principle of the expansion of steam. The valve that admits the steam in the cylinder is shut, when the piston has performed about one-sixth of its stroke; and the steam that is in the cylinder expands and forces it the rest of the way. Steam of about 30 lbs. or 40 lbs. pressure on the square inch is used, and they also condense their steam. The engines now used at the Cornish mines, are most all of them on this plan. And from the Reports published monthly, some of the best of the Cornish engines do double the duty of those made on Boulton and Watts's plan. I will leave "A Young Engineer," to judge whether or not they are likely to supersede those on the old plan. They likewise will do all the duty required in a mine equally as well, and at half the expense of any others.

"N. M. T." The best work on algebra is a little book published by Souter, in Fleet Street, by Young. There are two parts of it, and the price is within every one's pocket. D. T.

TO CORRESPONDENTS.

Scientia.—*No paper has been received upon electricity, beyond that which was inserted in No. 98.*

G. F. Gibbs *can obtain the Index, &c., to Vol. V. at our Publishers.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 99, NEW SERIES. | SATURDAY, JULY 4, 1840. PRICE ONE PENNY. | No. 220, OLD SERIES.

FANO'S FIRE-ESCAPE.

Fig. 1.

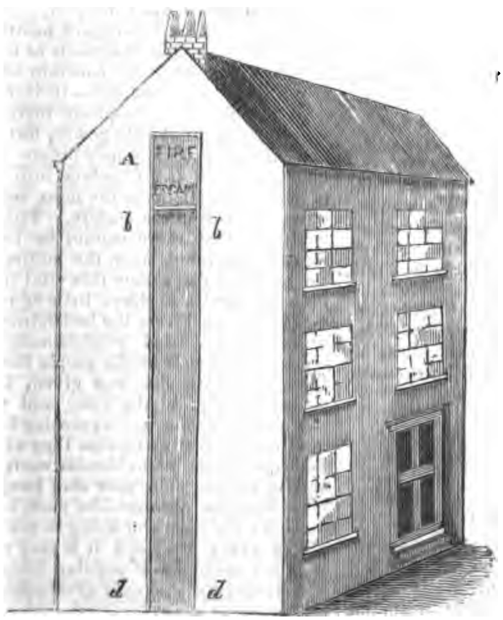


Fig. 3.

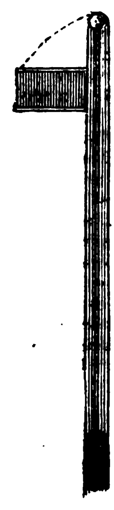
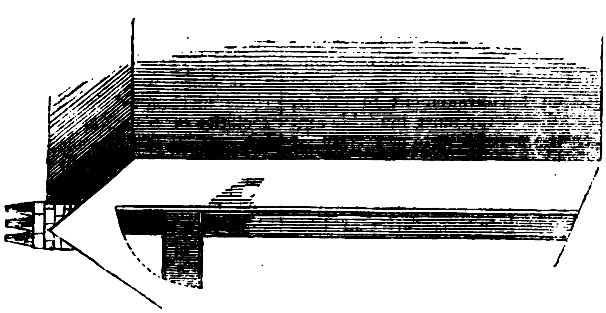


Fig. 2.



 City Press 1, Long Lane, Aldersgate Street · D. A. Doudney.

arguments, and many more that might be adduced, will have some weight—especially as they are sanctioned by the practice of all ages, from the remotest period recorded in history, up to the present time. Unfortunately, however, it happens, that all men are not rational, and it is found that the *abuse* of inebriating liquors begets a desire for still greater and more fatal excess; and an inconceivable phrensy impels those who are least able to afford the loss of time, money, and intellect, to abandon themselves to unbridled indulgence in the degrading, brutalizing, and destructive practice.

It is related of Sir Mathew Hale, that in his youth he frequented a society of profligate reprobates and drunkards; and being extremely shocked by the sudden and awful death of one of his companions, in the midst of a scene of riot and debauchery, he immediately retired, and took a solemn oath that no wine, or other intoxicating drink, should ever again pass his lips. He kept his word, and attained the high office of Lord Chief Justice of the King's Bench, and left a name which will be celebrated for wisdom and integrity as long as the history of our country is preserved. No one ever thought of ridiculing Sir Mathew Hale for his abstinence, although he was, to all intents and purposes, a teetotaller; nor does Byron's Corsair appear ridiculous, though also a teetotaller; how comes it, then, that so much contumelia and ridicule are heaped upon the teetotallers of the present day? We believe the whole secret to be in their injudicious adoption of a silly *sobriquet*, which suggests the idea of something vulgar and ridiculous; and we are certain that we are giving them good and sound advice, when we recommend them to assume a title more dignified and more English than that by which they are at present known.

The following is from the prospectus issued by the directors of the Institute:—

"The principle adopted by teetotallers, in abstaining from intoxicating drinks, is one of the most important steps towards the attainment of a large portion of real happiness. Enjoyments of an intellectual kind are, among the middle and working classes, chiefly to be attained by the teetotaller. Yet, mere abstinence from intoxicating drinks is but a mean to an end. The principle, however, is natural, and will, therefore, have the assistance of the Author and Supporter of nature. Although all this be true, yet every individual who has signed the charter of his freedom from the slavery of the drinking customs of society, has new habits to commence; and if those habits are not productive of a large amount of real and self-evident advantage to him, either of a physical, an intellectual, or a moral kind, the community is not benefitted to the utmost amount which is practicable by the change.

To aid, then, in this new state of society, which teetotalism does, and inevitably must yet farther produce, measures must be adopted to meet the growing demand for mental improvement and legitimate relaxation. This Association proposes to use all its energies to give a right direction to the thinking powers of the above classes, keeping in view the greatest of all principles—'Glory to God in the Highest—good will to man—peace on earth.' They intend to endeavour to accomplish these objects, by creating the means of attracting individuals to the improvement of their mental faculties, and to the pursuit of physical and intellectual science.

The means to be employed in effecting such objects, are intended to be, in the first instance, public and private lectures of the most useful description, interspersed with musical selections, both of a sacred and highly intellectual description. Occasional discussions and illustrated lectures on the most useful of the sciences, embracing every subject of real advantage to the greatest number, but always excluding party politics and sectarian religion. The admission to be by tickets.

The directors, therefore, invite every teetotaller who desires to connect rational enjoyment with solid improvement, to become a member, the expense being within the power of all.

To parents and guardians, the Institute presents advantages of such a nature, as will aid them in the development of the powers of youth, towards the attainment of every truth that can raise the tone of intellectual intercourse, and render life happy and useful.

And to all who desire to ameliorate the condition of the great majority of our population by literary and intellectual pursuits, and by innocent recreation, this Institute will present features of peculiar advantage."

ADULTERATION OF SOAP.

Most of our readers are, doubtless, aware, that a patent was granted several years ago, for a process of making spurious soap from burnt flints, and ingeniously imposing upon the public, and cheating poor washerwomen by Act of Parliament. The following is extracted from a report

of the Commissioners of Excise on the specific gravity of soap:—

"With regard to silica and clay soap, the experiments made by the writer of this report are not sufficiently numerous to give the requisite information; but as neither the silica nor the clay contributes anything to the detergent qualities of the soap, but merely increases its weight, all such additions ought to be prohibited by Government. Suppose a pound of good soap to cost 6*d.*, and that another soap, containing twenty per cent. of silica or clay, is sold at 4⅘*d.*, the two will be exactly of the same value; for four pounds of the good soap will go as far as five pounds of the adulterated soap. If the manufacturer charges 5*d.* for the pound of the adulterated article, he overreaches his customers to the extent of a farthing per pound. If this apparent cheapness have a tendency to increase the sale of soap, it operates as a premium to induce manufacturers in general to adulterate the article. The great extent to which the trade of Great Britain has reached, was originally founded on the goodness of the articles manufactured. The present rage for cheapness has a universal tendency to adulterate every article exposed for sale; and, unless it is counteracted by a vigilant Government, it must terminate in the destruction of the foreign trade of the country. The soap made for exportation is always of inferior quality; hence the monopoly of the French soap-makers, who supply Italy, Spain, and South America, with all the soap required by these extensive countries. If silica soap be permitted to be made, it ought to be charged according to its specific gravity, allowing it to contain twenty per cent. of silica, as the maker supposes it to do. Hence its specific gravity in the liquid state ought to be 1.3191. Hence a pound of it will have the bulk of 21.016 cubic inches; or it ought to pay one-fourth more duty than common yellow soap. In what is called clay soap, the clay is not at all combined with the alkali, no soap is formed with it; and its action is merely mechanical; and, in fact, it diminishes the power of the soap with which it is mixed in proportion to the quantity. The motives for mixing clay with soap are too obvious and too well understood to require any comment."

A Cold Lute.—Salt and whiting, properly kneaded with water, make a very hard and durable cement for many purposes, particularly for securing the joints of the apparatus for the production of carburetted hydrogen gas.

NEILSON'S IMPROVED METHODS OF PREPARING GELATINE, &c.

(Continued from page 69.)

I shall now describe the method by which I prepare the gelatine, which I call my gelatine of the second quality, and, for the purpose of reference, I designate this method the third operation. In making this gelatine, I use any such glue-pieces as are hereinbefore mentioned, not being putrescent; and after they have been freed from hair or wool, flesh and fat, and are washed clean in cold water, I steep or soak them in a weak solution of acid other than sulphurous acid; and I prefer to use sulphuric acid, muriatic acid, or acetic acid, but I find sulphuric acid the most convenient; and I add acid to such solution from time to time, until the glue-pieces have an excess of acid. Any vessel may be used for this purpose, which will not be acted upon by acid. Or, instead of thus steeping or soaking the glue-pieces, I sometimes place them in a wooden closet, constructed in the ordinary method, to prevent the escape of gas, and there expose them to the direct action of sulphurous-acid gas produced by the combustion of sulphur within the closet, and continue them thus exposed to the direct action of such gas until they have an excess of acid. I ascertain whether the glue-pieces have an excess of acid, by testing them with litmus paper in the ordinary manner. So soon as they have such excess, I remove them from the solution, or from the closet (as the case may be), and put them into any convenient wooden vessels; and I keep them in these vessels, at a temperature of about 70° of Fahrenheit, about three weeks; I then put them into the steam-baths, and apply heat to these baths, in any convenient manner, until the glue-pieces attain a temperature of about 180° of Fahrenheit, and I keep up this temperature until the glue-pieces are entirely dissolved.

The liquid then formed is gelatine; and I then proceed to treat this gelatine in the same manner as I have already mentioned, in describing the method designated the first operation, after I have stated that the glue-pieces have been almost entirely dissolved, until this gelatine has been completely dried, and it is fit for use. In describing the method which I have designated the second operation, I have stated that a residuum of the cuttings remains undissolved. I use this residuum for the purpose of preparing the gelatine, which I call my gelatine of the second quality, in the manner hereinafter mentioned. After

this residuum has been separated from liquid gelatine, as hereinbefore mentioned, I put it into vessels constructed of wood or other suitable material; and while it remains in a heated state, I add to it, from time to time, diluted acid, not being sulphurous acid, until such residuum has an excess of acid; and I ascertain whether it has such excess, by testing it with litmus paper in the ordinary manner. I prefer to use sulphuric acid, muriatic acid, or acetic acid; but I find sulphuric acid the most convenient. This residuum, when it has an excess of acid, and the residuum which I have stated remains undissolved, in describing the method designated the first operation, as this last-mentioned residuum is separated from liquid gelatine, may be treated either alone or together, with such glue-pieces, having an excess of acid, as I employ in preparing my gelatine of the second quality, in all respects in the same manner as I have already pointed out or referred to, as my mode of treating such glue-pieces, in describing the method which I have designated the third operation. If the residuum or the glue-pieces which I have in preparing the gelatine, which I call my gelatine of the second quality, has been exposed to the action of sulphurous-acid gas or of sulphuric acid, I prefer to remove from them any excess of acid, by adding a suitable quantity of lime or carbonate of lime, to the liquid gelatine produced from them; immediately after, I remove such gelatine into the setting vessels, and in this case I allow such gelatine to remain undisturbed in the setting vessels, at a temperature not less than 100° of Fahrenheit, for a period of about twelve hours; I then remove this gelatine from the setting vessels, in the manner which I have already described; and I pour it upon the cooling slabs, as already pointed out and allow it to remain upon these slabs, until it becomes cold, and sets into a firm substance; I then cut it into pieces of a convenient size, and dry it on nets, by exposure to a current of cool dry air; and when it has been thus completely dried, it is fit for use. The gelatine, which I prepare by any of the methods hereinbefore mentioned, has the properties of, or resembles glue, and may be applied to all the purposes for which gelatine is commonly used, under the name of size or glue; but my gelatine of the first quality may also be applied to culinary purposes.

THE CHEMIST.

ON ALKALIES.

(Continued from page 70.)

NICOTINA (Vegeto).—This alkali is a peculiar principle, obtainable from the seeds and leaves of the tobacco plant, by infusing them in acidulated water, evaporating the solution to a certain point, then adding lime; distilling and treating the product that comes over with ether. It is colourless, has a pungent smell, and an acrimonious taste; volatile at 212°, and remains liquid at 20° Fahr.; mixes in all proportions with water, but is, in a great measure, separable from it by ether, which dissolves it abundantly. It combines with acids, forming salts, which are acrid and pungent like itself. The tartrate, phosphate, and oxalate, are readily crystallizable. It is very poisonous; "a single drop of it being sufficient to kill a dog."

Potassa (Vegeto and Earthy) is chiefly procured by lixiviation from the ashes of burnt wood and other vegetable substances, weeds, &c. The following table is founded upon the experiments of Kirwin, Vauquelin, and Pertuis; it contains a statement of the quantity of potashes afforded by some common trees and plants:—

10.000 parts of	Poplar	7
	Beech	12
	Oak	15
	Elm	39
	Thistle	53
	Vine	55
	Fern	62
	Cow Thistle	196
	Beans	200
	Vetches	275
	Wormwood	730
	Fumitory	760

The water, after having passed through the ashes, is called the "ley." This is evaporated in iron pans or pots (hence the term potash, which the present nomenclaturists have converted into *potassa*) to dryness; two or three are generally used. As fast as the ley is concentrated, it is passed from one to the other. By this means much time is saved, as the weak leys evaporate more quickly than the strong ones. The salt thus procured is of a dark colour, and contains much extractive matter. It is then carried to a reverberatory furnace, in which the extractive matter is burnt off, and much of the water dissipated. In this operation it loses from ten to fifteen per cent. of its weight. The salt thus purified, is called pearlash in commerce. To obtain potassa

chemically pure, recourse must be had to either the bicarbonate, nitrate, or tartrate of potassa; for instance, the bicarbonate having been ignited in a silver crucible, is to be dissolved in six times its weight of water; the solution is then to be boiled for one hour along with one pound of lime, for every pound of the salt used. It must then be left to settle out of contact of air. The supernatant liquor is then to be drawn off by a siphon, and evaporated in a clean iron or silver vessel, provided with a small orifice in its close cover for the escape of steam, till it assumes the appearance of oil, or till it be nearly red hot. It is then to be poured out upon a bright plate of iron, cut into pieces as soon as it concretes, and put immediately into a bottle provided with a well-ground stopper. Thus purified, it is a hydrate of potassa. It is white, very acrid, and corrosive: at a bright red heat it is volatilized. It is decomposed in contact with charcoal at a white heat. It quickly absorbs moisture from the air. When touched with damp fingers, it has a soapy feel, in consequence of its action on the skin. It dissolves sulphur, alumina, and silica. It forms a various class of salts with acids; the most important of which is the nitrate (or saltpetre). This alkali was of the first that was decomposed by Sir Humphrey Davy; he found it to consist of—

	Davy.		Dr. Ure.
Potassium......	85	..	83.34
Oxygen........	15	..	16.66
	100		100.00

Pure dry potassa can only be obtained by burning the metal potassium in pure and dry oxygen gas.

Quina or *Quinine* (Vegeto) and cinchonia, are two alkalies that exist in Peruvian or Cinchona bark; the former is most abundant in the yellow bark, while the latter is in the grey. The method of extracting quina from the yellow, is precisely the same as for obtaining cinchonia* from the grey bark. Quina is white; has an alkaline reaction upon the proper tests. It forms distinct salts with acids. The sulphate has the remarkable property of becoming luminous, when heated to a temperature of 100° Fahr., more especially if slightly rubbed. It is soluble in ether and alcohol, but slightly in water. It has an exceedingly bitter taste, if dissolved in dilute sulphuric acid. According to a recent analysis of M. Liebig, it is composed of—

Carbon	75.76
Hydrogen	7.52
Nitrogen	8.11
Oxygen	8.61
	100.00

* See page 292, Vol. V.

MISCELLANEA.

OLD RECIPES.

To Remove Wrinkles from the Face.—Make an iron shovel red hot; throw thereon some powder of myrrh; receive the smoke on your face, covering the head with a napkin, to collect the smoke and prevent its being dissipated. Repeat this operation three times, then heat the shovel again, and, when fiery hot, spout on it a mouthful of white wine. Receive the steam of the wine also on your face, and repeat it three times; and, by repeating this operation every night and morning, you will soon remove the complaint.

To Remove Corns from the Feet.—Roast a clove of garlic on a live coal, or in hot ashes; apply it to the corn, to which it must be fastened by a piece of cloth, and administered when going to bed. In the morning wash the foot with warm water, and the horny tunic of the corn will disappear. It is right to renew this application for two or three nights.

To Quicken the Growth of Hair.—Dip the teeth of your comb every morning in the expressed juice of nettles, and comb the hair the wrong way, and it will surprisingly quicken the growth of the hair.

Remedy for Decayed Teeth.—Make a balsam with a sufficient quantity of honey, two scruples of myrrh in fine powder, a scruple of gum juniper, and ten grains of roach alum. Frequently apply this mixture to the decayed tooth.

To make the Teeth look White.—Rub them well with nettle or tobacco ashes, or with vine ashes and a little honey. G. F. Gibbs.

Yellow Sympathetic Ink.—Dissolve an ounce of sulphate of copper (blue vitriol), and another of muriate of ammonia (sal ammoniac), in six ounces of water, diluting it gradually with more water, till it ceases to leave a visible trace upon paper. This ink is invisible when dry, but appears of a beautiful yellow, by heating the paper, and disappears when the paper is cool.

To make Gunpowder.—Take four ounces of refined saltpetre, one ounce of brimstone, and six drachms of charcoal; reduce these to a fine powder, and continue beating them for some time in a stone mortar with a wooden pestle, wetting the mixture with water, so as to form it into a uniform paste, which is reduced to grains, by passing it through a wire sieve; and, in this form, being carefully dried, it becomes the common gunpowder.

To make a Lead Tree.—To a piece of zinc fasten a wire, crooked, in the form of the worm of a still; let the other end of the worm be thrust

through a cork. You then pour spring water into a vial or decanter, to which you add a small quantity of sugar of lead; thrust the zinc into the bottle, and, with the cork at the end of the wire, fasten it up. In a few days the tree will begin to grow, and produce a most beautiful effect.

To produce Cold.—Take a small vial in one hand, containing some pulverized muriate of ammonia, pour a little water upon it, and shake the mixture, when a sensation of cold will be produced.

The Electrical Fountain.—Suspend a vessel of water from a brass arch, and place in the vessel a small tube. When electrified, the water will be one continued stream; and if the electrification be strong, a number of streams will arise in the form of a cone, the top of which will be at the extremity of the tube. This experiment may be stopped and renewed as if at the word of command.

To produce Gas Light on a Small Scale.—Take a tobacco-pipe, and nearly fill the bowl with coal dust, and then stop up the bowl with a cement made of beer and sand; then place the bowl in a fire between the bars of the grate, so that the pipe may stand nearly perpendicular; in a few minutes gas will escape from the orifice of the pipe, when, if a light be applied, it will take fire and burn for several minutes with a small but clear flame.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, July 8, W. Maugham, Esq., on Voltaic Electricity. Friday, July 10, T. Adams, Esq., on Music. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, July 9, Mr. W. H. J. Traice, on the Comedy of "As You Like it." At half past eight.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, July 8, Mr. Gaze, on Pneumatics. At eight o'clock.

QUERIES.

How to prepare wash-leather; and how to make a good, but cheap bleaching powder?

E. GARRETT.

Being about to fit up a camera obscura, I shall feel obliged if any of your optical correspondents will answer the following questions:—The mirror is 9 in. by 12 in.; the lens, 6¼ diameter, plano-convex; the focus, 4 ft. What will be the diameter of the image it will throw, and what will be the radius for curve of the table?

S. C.

A receipt for manufacturing purple and blue ink?

A. CLERK.

[Several good receipts for making blue ink have appeared in the "Mechanic." See page 176, Vol. IV.—ED.]

The best means of cleaning and restoring wall papering?

H. S.

How to make a velocipede on the best principle? Also how to make crimson and other coloured stars for Roman candles, &c.? The receipts already given in the "Mechanic" for coloured fires, will not suit my purpose.

A YOUNG EXPERIMENTALIST.

ANSWERS TO QUERIES.

To make Bottle Lemonade.—Dissolve half-a-pound of loaf sugar in a quart of water, and boil it over a slow fire; two drachms of acetic acid, and four ounces of tartaric acid; when cold, put twopennyworth of essence of lemon. Put one-sixth of the above into each bottle filled with water, and put thirty grains of carbonate of soda, and cork it immediately, and it will be fit for use.

A. Y. E.

To Purify Quicksilver.—By distillation in iron retorts.

To make Sulphuretted Hydrogen.—Melt together in a crucible three ounces of iron filings and one ounce of sulphur; reduce the mass to powder, and put it with a little water into a gas-bottle with two mouths. In one of the mouths insert a tube (run through a cork), bent in such a manner as to convey the gas into whatever vessel is wanted to contain it; into the other mouth pour some diluted muriatic acid, and stop it immediately. The gas will now be disengaged in large quantities through the other tube.

B. MOUNTFORT.

TO CORRESPONDENTS.

J. Barry.—*We are not in possession of the address of the correspondent who favoured us with the description of a vertical saw frame in No. 88, N.S.; but we trust he will oblige us with a more detailed account of his invention, as he has offered to do.*

S. C. *is mistaken in his remarks on the astronomical question. A celestial phenomenon may occur, which is visible nearly at the same instant at different places; but the nominal time varies with the longitude, a circle of the earth being equivalent to twenty-four hours. The real difference is caused by parallax.*

B. Mountfort.—*His explanation is sufficiently clear without the drawing. It is desirable that drawings intended for engraving, should be accurately executed, and of the proper size; as it causes unnecessary inconvenience and expense to enlarge or diminish the scale.*

R. P. Batger.—*The notices of lectures came too late for insertion. We shall be happy in future to publish them, and otherwise to promote the good cause for which the Institute is established.*

W. H. Hewett *will find some letters addressed to him at our office, Long Lane.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 100, NEW SERIES. | SATURDAY, JULY 11, 1840. PRICE ONE PENNY. | No. 221, OLD SERIES.

BROWN'S PATENT FIRE-PLACES.

FIG. 1.

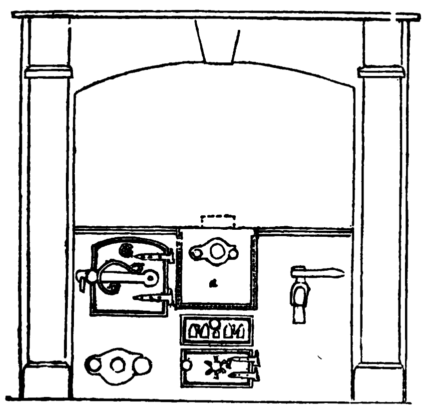
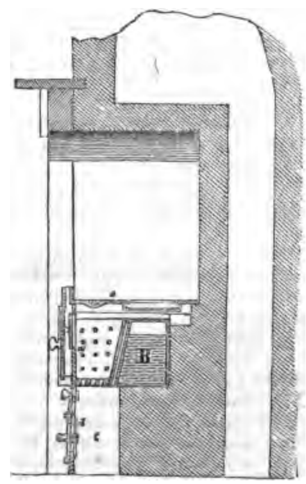
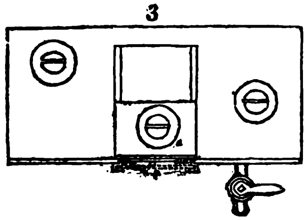


FIG. 2.



3



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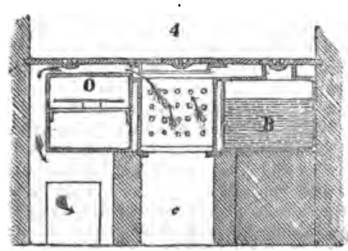


City Press 1, Long Lane, Aldersgate Street: D. A. Doudney.

BROWN'S PATENT FIRE-PLACES.

(See Engraving, front page.)

My invention relates to a mode of constructing the fire-places of such description of stoves as are called cooking-stoves or ranges, and consists in so arranging the fire-place, that the process called roasting may be performed by means of a heated plate in front of the fire-place, thus enclosing the fire, whereby not only is the process of roasting more advantageously performed, but that the heat of the fire economised in the fire-place for performing the processes of baking and boiling. And, in order to give the best information in my power, I will proceed to describe the drawing hereunto annexed.

Des ription of Engraving.

Fig. 1 is a front view of a cooking-stove or range with the fire-place, and parts connected therewith, constructed according to my invention.

Fig. 2 is a transverse section.

Fig. 3 is a plan of the top of the stove or range; and

Fig. 4 is a front section. In each of these figures, the same letters indicate similar parts.

An iron plate, *a*, is substituted instead of the ordinary front fire-bars, before which roasting is performed in a very superior manner, owing to the regularity of the heat produced, and entire freedom from dust and ashes. The whole surface on the top presents an extensive hot plate. The fire is thus entirely closed. The boiler forms the back and one side of the fire-place, the other forms the opposite side, which are protected by thick cast-iron plates. The whole heat produced being thus confined, is applied for all the purposes of cooking; and it will be found that a very small proportion of fuel is requisite, compared with the quantity used in the fire-places of ordinary cooking-ranges. Near the top of the roasting-plate (above the body of the fire) a small door is introduced, which gives this stove the advantage of an enclosed fire for cooking; and when not required for that purpose, the door may be opened, affording the comfort of an open fire combined with a saving in fuel; for it will be evident, that nearly the whole of the draught admitted, passes over the fire, which has a tendency to check the effect of the draught of air admitted below; a greater supply of hot air is also produced, which passes entirely round the oven, consequently less fire is requisite for baking. Below the roasting-plate are some gothic openings; *b b*, in which talc is introduced, to show by reflection the state of the fire; beneath these openings is the ash-hole, *c*, which is also enclosed; the draught is admitted to the fire through a ventilator, *d*. On the top is a sliding-plate, *e*, where the fire is supplied with fuel. The boiler is fixed upon solid masonry, and requires no other heat than that which it receives from the back and side of the fire. The heated air passes over the oven, it then descends on the opposite side, and passes under the oven into the flue, as is clearly indicated in the drawing; the oven is thus constantly heated in a very superior manner, the heat being more regular than in the ordinary mode of fixing them. The roasting-plate is enclosed b·· a moveable front, *f*, on the top of which is a small socket, the bottom being left entirely open, a current of air is produced between the two plates; thus a considerable portion of hot air is generated, which, if required, may be conducted to any part of the house. If the hot hair is not required for any purpose, it may be conducted into the chimney. This will be found very advantageous during the summer season, when the convenience of a fire is required without the inconvenience of the heat produced thereby.

ON ELECTRICITY.*

NO. IV.

What is electricity? Electricity is a fluid of which we know nothing, except from its results; a fluid which pervades the surface of every material substance. It pervades our houses, bodies, clothes, the air we breathe, and, in fact, the whole of nature. But why, it may be asked, do we not perceive it; why are we not sensible of its presence? I answer, because it is in a state of equilibrium. Although every substance possesses a certain quantity of this fluid, yet it remains perfectly quiescent till its equilibrium is disturbed, or, in other words, till it possesses more or less than its natural quantity. But as soon as this is the case, its presence can immediately be detected. To illustrate this, take a stick of sealing-wax and woollen cloth, both of which substances possess a certain quantity of electricity, which is in a state of equilibrium; but as soon as these are rubbed together, the equilibrium is destroyed by the friction;

* This paper was by mistake omitted in its proper place; it should have appeared after No. 2, page 297, Vol. V.

a portion of the electric fluid immediately leaves the wax, and enters the flannel; the wax then possesses less, and the flannel more than its natural quantity. Now hold either the wax or flannel over a few light substances, such as strips of paper, pieces of cork, &c., and they will immediately be attracted by it; and attraction is the sign or evidence of the presence of this fluid. It is evident, then, by this experiment, that we obtain or accumulate electricity and detect its presence, by means of friction between two substances (by rubbing the sealing-wax and flannel together); and this process is what electricians term excitation. All bodies do not naturally possess this property; those which do, are termed electrics; those which do not, non-electrics. The following is a table of the principal electrics and non-electrics:—

ELECTRICS.	NON-ELECTRICS.
Silver	Shell-lac
Copper	Amber
Lead	Resins
Gold	Sulphur
Brass	Wax
Zinc	Glass
Tin	Diamond
Platina	Raw Silk
Iron.	Dyed Silk.

A farther difference likewise exists between electrics and non-electrics; the former possessing the power of insulation, while the latter, that of conducting electricity; both which properties are exactly the reverse of one another, and, therefore, cannot be united in one and the same substance. Insulation is that peculiarity of bodies, which enables them to impede the passage of electricity. This fluid has, like water, for example, naturally a tendency to spread itself in all directions, and, therefore, it would be impossible to collect it for the purposes of experiment, except there were some means of confining it; and this is afforded by means of electrics or insulators. Glass, among others, is an insulator; and it is for this reason that we let the prime conductor of the machine rest upon a pillar of that substance, when we wish to accumulate electricity in the conductor, and for this purpose oppose an insulator between it and the ground. We can thus obtain a strong shock, when the machine is in action, which would not happen, did not the pillar of glass prevent its escape.

The property of conducting bodies is exactly the reverse of this; they do not impede, but, on the contrary, carry away the electric fluid. In illustration of this, place a chain upon the prime conductor of the machine, and communicate it with the ground, then turn the machine, and not a single spark can be obtained; the electric fluid being carried or conducted away by means of the chain.

We have before stated, that if a tube of glass, or stick of sealing-wax, be rubbed with a piece of dry silk or woollen cloth, that it acquires the property of attracting light bodies. These bodies, after they have been for a short time in contact with the electric, are then repelled by it; and if the electric be again presented to them before they have touched the earth, or any other conducting body, they will be farther repelled; if they have, they will again be attracted.

(To be continued.)

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(Continued from page 21.)

COVENTRY is a city of great antiquity, 91 miles from London, 18 from Birmingham, 10 from Warwick, and five from Kenilworth. It was formerly written *Conventria*, or *Conventry* (from a convent which was founded there at a very early period, long before the Conquest), and the ancient British *Tree*, a town. It is a borough, city, and county of itself, but *locally* in the county of Warwick. The chief parts of the city are seated on a gentle acclivity, and watered by the Radford and Sherbourn brooks. Coventry was formerly surrounded by walls three miles in circumference, of great strength, and fortified with thirty-two towers. This work was commenced in 1355, and completed in about forty years. In the reign of Charles II., the wall and towers were demolished with the consent of the citizens, and the town thrown open. Most of the gates were, however, spared; but only three out of twelve now remain, and those of a subordinate character, and in a dilapidated condition. Some remains of the wall may still be traced in several districts, but they are fast disappearing. Notwithstanding numerous modern improvements, many of the streets are narrow and badly paved, and the houses from three to four centuries old, presenting an aspect more gratifying to the antiquarian, than flattering to the taste and judgment of our ancestors. Coventry has been singularly fortunate in escaping from fire; not a single conflagration of any considerable extent having occurred for centuries past;

as is attested by the old projecting pestiferous houses which still exist in the various districts of the town, or have been purposely removed, to make room for more spacious streets and commodious houses. There are three churches—St. Michael, Trinity, and St. John. *St. Michael's* is a superb structure of the fourteenth century, in the Gothic style of architectuie. The tower is 136 feet in height, and surmounted by an elegant octagonal spire, altogether 300 feet high. The windows of the upper story, which range along the whole of the sides, are decorated with ancient paintings of religious subjects. The ceiling is of oak, ribbed and carved. *Trinity Church* is contiguous to St. Michael's ; it is a handsome cruciform building, though inferior in elegance and grandeur to its stately companion. *St. John's* is also a cruciform structure, with a square embattled tower and round turrets. There are some other important buildings in this town, among which, *St. Mary's Hall* is particularly deserving the attention of the antiquary. The historical events connected with Coventry, are both numerous and important; but it would exceed our limits even to enumerate them. The legend of Lady Godiva is pretty generally known throughout England ; but it is not so universally known, that the whole story is a fabrication without any foundation in truth. A procession in honour of Lady Godiva was, till within the last thirty years, paraded through the town every year ; it consisted principally of St. George of England on his charger, and a lady representing Lady Godiva, followed by the Mayor and corporation, &c. This ceremony was first instituted in 1677, in the reign of Charles II., about 600 years after the time of Godiva. In Gough's edition of Camden's *Britannia*, it is stated that Mathew of Westminster, who wrote in 1307, that is, nearly two centuries and a half after the time of Leofric and Godiva, is the first who mentions this legend ; and many preceding writers who speak of Leofric and Godiva, do not mention it. The invention of this story was probably suggested by an inscription in Trinity Church, where a picture of Leofric and his lady was set up about the time of Richard II. He is represented holding a scroll with these words :—

I, Luriche, for love of thee,
Doe make Coventre toll free.

The legend itself is too well known and too foolish to require repetition.

DR. TURNBULL.

Some months have now elapsed since we have introduced the worthy doctor to our readers. A case, however, having just come under our notice, we cannot forbear mentioning it. Accidentally meeting a young lady the other day, who it appears had for some considerable time been labouring under the painful malady of deafness, we strongly advised her to pay a visit to Russell Square, and try the skill of Dr. Turnbull. Having sought the assistance of several of the most reputed physicians of the day, to little or no purpose, she appeared at first somewhat reluctant to do so; but an assurance of his very general success, having at length overcome her objections, she was induced to wait upon the doctor. She has paid him, we believe, but three visits ; and we have the pleasure of informing our readers, that she called upon us this day, on her way to Dr. T., so far restored as to betray little or no symptom of a want of hearing. Another case we may just mention—that of a very near relative. For ten or twelve years she had been exceedingly deaf, so much so that she very rarely heard a public speaker, and in a room could only converse with any degree of freedom, by means of an Indian-rubber tube. Every measure that could be adopted had been adopted, to regain her hearing, but in vain; almost every physician that could be consulted, had been consulted, but in vain; and her case was considered a hopeless one, when she first heard of, and called upon Dr. Turnbull. Upon her first visit, he said she would not again require the use of the Indian-rubber tube, before referred to; *she has never used it from that day to this.* And, though she has shown irregularity, and a great want of perseverance in her attention to the means prescribed, a great improvement has taken place. We have stated *the facts*—we leave them with our readers and the public generally, without comment; presuming clearer and more satisfactory cases of Dr. Turnbull's skill, to be unnecessary.

PENNY-POSTAGE STAMPS.

To the Editor of the Mechanic and Chemist.

Sir,—Having observed, as, I believe, has every one, the ludicrous and even disgusting appearance which the portrait of our most gracious Queen presents on letters which have passed through the Post-office, I beg to suggest, as a means of avoiding this evil, that in printing the sheets of portraits, there be left between

each row of these a white space ; so that, on being cut out, each head may have a blank underneath it to receive the Post-office stamp. Moreover, the blank spaces between the lines of portraits, might easily be made to undergo such a preparation, as would preclude the possibility of the Post-office mark being effaced by any chemical process without detection.

Yours, most respectfully,

J. M.

Twickenham.

[We agree with our correspondent in condemning the present arrangements for stamping letters. The adhesive stamp is, at best, a most despicable production, and with the addition of the red stamp, it becomes hideous ; the engraved covers and envelops might do for a pot-boy's valentine, but it is an insult to the commerce of this country, to suppose that merchants will approve of such foolery in their correspondence. J. M.'s regret would kindle into indignation, if he were to see the beautiful models of stamps which have been rejected. The subject will be brought before the House of Commons very shortly, when the present regulations will probably undergo considerable alterations ; but it is not expected that any alteration will take place in the rates of postage.—Ed.]

RAPER'S PATENT IMPROVED WATERPROOF FABRICS AND LEATHER.

(Abstract of Specification.)

My improvements in rendering fabrics and leather waterproof, without obstructing air or perspiration, or imparting any unpleasant odour, consists of a mode of waterproofing fabrics and leather as hereafter described.

First, I prepare, in the following proportions, a fluid of one ounce of good gelatine to one quart of hot water, and a drachm and a half of carbonate of ammonia, or half-a-drachm of pure liquid ammonia.

Secondly, I prepare a concentrated solution of sulphate of soda, or of sulphate of potash, or of sulphate of ammonia, or of phosphate of soda.

Thirdly, I prepare a concentrated solution of acetate of lead.

Fourthly, I prepare the foregoing liquor for a bath. I triturate four pounds of fuller's-earth with half-a-pound of camphor in powder, and gradually stir these into forty gallons of pure or distilled water, and, before the precipitation of the fine particles, I draw off the liquor into a suitable vessel. The fabric to be waterproofed I immerse in the first fluid composition and dry it, and then I again immerse it in the second fluid or solution, and after a suitable time I remove it into the third fluid or solution, and from thence into the fourth composition or bath, where I recommend it to be kept immersed for some time, and then properly washed and dried, and afterwards dressed and pressed as cloth-dressers finish their cloths or fabrics.

From the foregoing description, aided by a little practice, the workman will readily be able to perform this invention, notwithstanding the varying nature of the different fabrics he has to operate on. And I would remark, that although I have been particular in thus describing the quantities of the various materials used, I do not confine myself thereto, nor to the salts above mentioned ; though I believe them to be the best for the purpose. And I would also remark, that although I recommend the using of the four liquors, it should be understood that the first and the fourth may be dispensed with, and yet produce a beneficial result in waterproofing fabrics and leather. I do not, therefore, confine my patent to the using all the four liquors, though I prefer to do so ; the object of the invention being to produce an insoluble compound in the fabrics or leather operated on by the employment of suitable salts.

WIESMANN'S PATENT PROCESS FOR MANUFACTURING ALUM.

(Abstract of Specification.)

My invention relates to a mode of manufacturing alum, by which the same may be produced free of iron and alkali, or nearly so; and in order to give the best information in my power, I will proceed to describe the process pursued by me. I take potter's clay, as free from iron as possible, and calcine the same to a moderate red heat, in order, as much as possible, to drive off all humidity. The clay so calcined is next to be ground to a powder, and to be placed in leaden pans heated by a moderate fire, or by steam, and sulphuric acid (about 66° by Beaumé) is to be applied in sufficient quantities, that the acid may dissolve nearly the whole of the clay. I prefer that the whole should not be dissolved, as a saving of acid is thereby obtained. The mass in the pan is to be stirred until it is dry, when boiling water is to be applied, to dissolve the salt formed, and water is to be applied till the whole of the salt is separated ; the liquids thus ob-

tained, are mixed and placed in vats, and left therein till perfectly clear. A measured quantity of the liquor is to be tested with prussiate of potash, or other suitable material, to ascertain the quantity of iron contained in such measured quantity of the liquor; then the whole quantity of liquor being known, the quantity of iron therein may be obtained by calculation; and whatever be the weight of iron the liquor to be operated on is found to contain, an equal weight of prussiate of potash dissolved in water is to be stirred into the liquor, which will take to the iron, and they together will be precipitated; by this means the liquor, drawn off clear or filtered, will be composed of sulphuric acid, alumina, and water, and in this condition may be used for the purposes of the arts; but when required to be crystallized, I reduce the liquor by quickly boiling and strong evaporation. Evaporating it in large leaden vessels, until a skin of salt forms on the surface, when the liquor is drawn into shapes, where it cools and crystallizes. I would here remark, that I am aware that clay treated with sulphuric acid, has been employed in the process of making alum, but the processes have been conducted in a different manner, requiring much time, and producing alum not so pure and concentrated. I do not, therefore, claim the same generally, when practised according to the means heretofore known. And, although I prefer the employment of prussiate of potash for precipitating the iron, I do not confine myself thereto; as other materials may be used, such as the lixivium of blood, or sulphate of lime. But what I claim is, the mode of making alum from clay, as herein described, whereby the alum will contain much more alumine, and is free, or nearly free from iron.

ON THE INSECT TRIBES.

NATURALISTS have found it necessary to arrange insects into different tribes or families, distinguished from each other by certain peculiarities in the structure of their bodies; such as their having or wanting wings, and from the number and substances of which these instruments of motion are composed.

No other classes of animals have more legs than four; but most insects have six; and some have eight, ten, fourteen, sixteen, and even a hundred. Besides the number of legs, insects are furnished with *antennæ* or feelers. These feelers, by which they examine the substances they meet with, are composed of a greater number of articulations or joints. When a wingless insect is placed at the end of a twig, or in any situation where it meets with a vacuity, it moves the feelers backward and forward, elevates, depresses, and bends them from side to side, and will not advance farther lest it should fall. If a stick or any other substance be placed within the reach of the feelers, the animal immediately applies them to this new object, examines whether it is sufficient to support the weight of its body, and in that case instantly proceeds on its journey.

Though most insects are provided with eyes, yet they can see distinctly but at small distances; and of course must be very incompetent judges of the vicinity or remoteness of objects. The feelers, which are in perpetual motion while the animal walks, remedy this defect, and enable it to proceed with safety in the dark.

Some of the insect tribes have four, and others, as the spider and scorpion, have eight eyes. The eyes of insects are absolutely immovable; but this defect is supplied by a contrivance which renders them capable of viewing objects in every direction, and also of seeing bodies that are too minute to be perceived by us.

There is another peculiarity in the structure of insects. They have no bones: but that defect is supplied in some by a membranous or muscular skin, and in others by a crustaceous or horny covering. In this circumstance, insects resemble the shell animals, whose bones constitute the outward parts of the bodies.

The mouth of insects is generally placed in the under part of the head; but in some it is situated in the breast. The greater number of winged insects are provided with a proboscis or trunk—a machine of a very complicated nature, which serves them to extract the juices from plants, to conduct the air into their bodies, and to convey the sensation of smelling. The substance of the trunk has some resemblance to that of horn. It tapers from the base to the extremity, and is composed of two similar and equal parts (each of them concave), which, when joined, form three distinct tubes, that serve as a mouth, a nose, and a windpipe.—*Mavor.*

Freezing Mixture.—Dissolve five drachms of muriate of ammonia and five drachms of nitre, in two ounces of water; a thermometer immersed in the solution, will show that the temperature is reduced below 32°. If a tube filled with water be suspended in the solution, the water will be effectually frozen.

THE CHEMIST.

CHEMICAL ANALYSIS.

(*Continued from page* 71.)

6. **Ammonia**, sp. gr. 0.5902 ; weight of 100 cubic inches 18.000 grs. Transparent, colourless, elastic, pungent smell; extinguishes combustion and animal life; acrid taste. Condensed by water, which dissolves one-third of its weight of the gas.

7. *Chlorine*, sp. gr. 2.500 ; weight of 100 cubic inches, 76.25 grs. Colour greenish yellow; peculiar smell and taste, which is not liable to be mistaken for any other gas. Inhaling of it causes a sense of strangulation. Supports combustion. Crystallizes at 40° Fahr.; the crystals are of a deep-yellow colour.

8. *Muriatic Acid*, sp. gr. 1.2840; weight of 100 cubic inches, 39.183 grs. Odour pungent; taste acid and corrosive; invisible; extinguishes combustion and animal life. It consists of chlorine and hydrogen in equal volumes; thus, 1 hyd. + 1 chlo.

8. *Sulphurous Acid*, sp. gr. 2.222; weight of 100 cubic inches, 67.77 grs. Absorbed by water at 61°; reddens and then destroys blue vegetable colours; taste acrid. Odour similar to that of burning sulphur.

10. *Sulphuretted Hydrogen*, sp. gr. 1.1805; weight of 100 cubic inches, 36.006 grs. Combustible; burns with a blue flame; odour resembling that of rotten eggs; taste sour; reddens vegetable blues; is absorbed by water, and deposits sulphur while burning.

11. *Nitrous Oxide* or *Protoxide of Azote*, sp. gr. 1.5277; 100 cubic inches weigh 46.6 grs. Respirable; taste sweet; agreeable odour; condensable by water; exhilarating; supports combustion.

12. *Nitric Oxide* or *Deutoxide of Azote*, sp. gr. 1.0416; 100 cubic inches weigh 36.77 grs. Water condenses about one-twentieth of its volume of the oxide; is absorbed by the protomuriate or protosulphate of iron, forming a dark-coloured liquid; causes red fumes when exposed to the atmosphere. Extinguishes combustion and animal life.

13. *Carbonic Acid*, sp. gr. 1.5277; weight of 100 cubic inches, 46.596 grs. Is absorbed by water, which becomes afterwards acidulous; reddens vegetable blues; sharp taste; entirely destroys animal life, as well as the irritability of the muscles.

14. *Carbonic Oxide*, sp. gr. 0.9722; 100 cubic inches weigh 29¾ grs. Inflammable; burns with a dark-blue flame. Water condenses one-forty-sixth of its volume of the gas. Fatal to animal life if respired.

16. *Carburetted Hydrogen* or *Coal Gas*, sp. gr. 0.978; 100 cubic inches weigh 28.80 grs. Destructive of animal life; when pure, devoid of colour, taste, or smell; burns with a white flame.

17. *Hydriodic Acid*, sp. gr. 4.4; 100 cubic inches weigh 134.2 grs. Invisible; odour resembling that of muriatic acid..

18. *Chlorocarbonous Acid* or *Phosgene* of Dr. Davy, sp. gr. 3.4722; 100 cubic inches weigh 105.9 grs. Suffocating and intolerable smell; does not fume in the atmosphere; reddens vegetable blues.

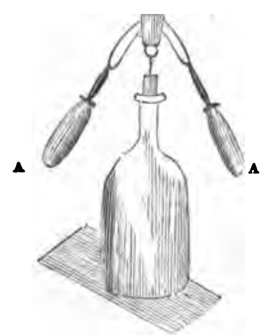
19. *Chlorous Oxide* or *Euchlorine*, sp. gr. 2.423; 100 cubic inches weigh 74 grs.; smell as of treacle; not respirable; yellow colour; soluble in water.

20. *Chloric Oxide* or *Deutoxide of Chlorine*, sp. gr. 2.361; 100 cubic inches weigh 77 grs. Deep-yellow colour; absorbed by water; astringent taste; destroys, but not reddens vegetable blues; explodes with phosphorus.

Manipulator.

MISCELLANEA.

To make a Shilling turn on its Edge on the Point of a Needle.—Take a bottle, and insert in the mouth, a cork with a needle in a perpendicular position; then cut a nick in the face of another cork, in which fix a shilling; and into the same cork stick two table-forks, A A, opposite to

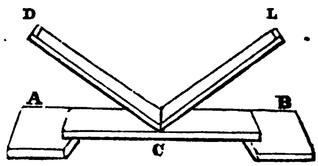


each other, with the handles downwards. If the rim of the shilling be placed upon the point of the needle, it may be turned round without any risk of falling off, as the centre of gravity is below the centre of suspension.

To make Artificial Magnets.—The best method of making artificial magnets is, to apply one or more powerful magnets to pieces of hard steel; taking care to apply the north pole of the magnet or magnets, to that end of the steel which is required to be made the south pole; and the south pole of the magnet to the opposite extremity of the piece of steel.

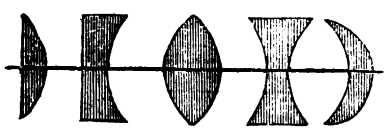
Place two magnetic bars, A and B, in a line, so

that the north end of one shall be opposite to the south end of the other; but at such a distance that the magnet, C, to be touched, may rest with its marked end on the marked end of A. Apply the north of C, the opposite ends being elevated, as in the figure. Draw L and D asunder; one to



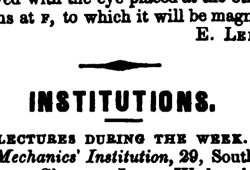
wards A, and the other towards B, and remove them a foot or more from the bar, when they are off the ends; then bring the north and south poles of these magnets together, and apply them again to the middle of the bar, C, as before. Repeat this process five or six times, turn the bar, and touch the other three sides in the same way, and with care, the bar will acquire a strong fixed magnetism.

Of Lenses.—Lenses are of different shapes, from which they take their names; they are represented here in one view:—*a* is a plano-convex, because one side is flat and the other convex; *b* is a plano-concave, one side being flat and the other concave; *c* is a double convex lens, because



both sides are convex; *d* is a double concave, having both sides concave; *e* is called a meniscus, convex on one side, and concave on the other.

The Single Microscope.—A is a circular piece of brass, in the middle of which is a very small hole; in this is fixed a double convex lens, the focal distance is O D; at that distance is a pair of



pliers, D E, which is adjusted by the screw, P; with these any small object may be taken up and viewed with the eye placed at the other focus of the lens at F, to which it will be magnified, as at I M. E. LEDGER.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, July 15, W. Maugham, Esq., on Voltaic Electricity. Friday, July 17, F. M. Innes, Esq., on the Present State and Future Prospects of the Australian Penal Colonies. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Wednesday, July 15, Quarterly General Meeting. At half-past eight.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, July 15, R. J. Jeffs, on Oxygen Gas. At eight o'clock.

QUERIES.

In No. 88, N. S., of your Magazine, a correspondent has given a plan and description of a vertical saw-frame; may I beg of you to give him a hint to fulfil his promise to those who would "wish to know more on the subject." I would wish to know what power is applied, and such particular information, as would enable any one of your readers to construct one similar to his own?

In No. 3, N. S., it is mentioned that a cement, which dries rapidly, is used for modelling buildings in pasteboard, called Indian glue; I would wish to know where it is to be procured, or how made? HENRY HILL.
Cork.

The right way to wind the copper wire round an electro magnet? J. B.

The best method of extracting oil from ivy berries? Also, how to prevent drawings from smearing? W. F. C.

ANSWERS TO QUERIES.

To find the Area of a Circle.—Multiply the square of the diameter by the square root of D, and divide the product by the square root of 3; thus:— $\frac{D^2 \times 2}{\sqrt{3}} = A$

If there should be any difficulty on account of this not exactly corresponding with the established rule, I shall then be ready and willing to clear it up, and, I believe, to your entire satisfaction. G. WADSWORTH.

Purified Animal Oil may be obtained of L. Rossi, No. 6, Everett Street, Russell Square.
A. O. S.

TO CORRESPONDENTS.

T. Abel.—*The action of the eccentric is, theoretically, the same as that of the crank; but the friction is much greater. For the best and simplest construction of a velocipede, we must appeal to our correspondents, trusting that we shall be favoured with the description of one that has been tested by experience.*

M.'s *directions for finding the specific gravity of gases, are both obscure and inaccurate.*

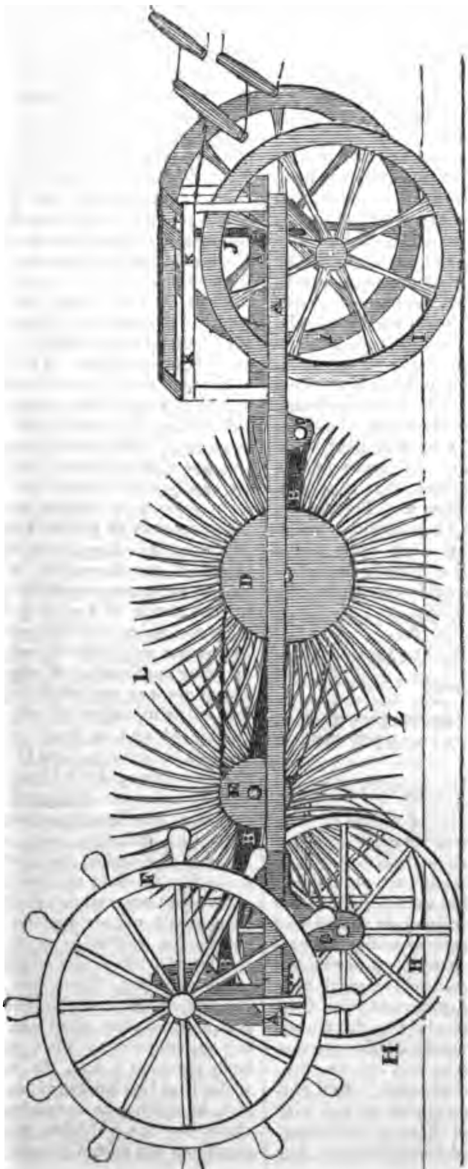
H. O. P. E. *and* J. M. D. *in our next.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 101, NEW SERIES. | SATURDAY, JULY 18, 1840. PRICE ONE PENNY. | No. 222, OLD SERIES.



VAUX'S PATENT PLOUGH.

City Press 1, Long Lane, Aldersgate Street: D. A. Doudney.

VAUX'S PATENT PLOUGH.

(See Engraving, front page.)

To the Editor of the Mechanic and Chemist.

SIR,—I send you the annexed drawing and description of Vaux's patent plough, as, I believe, it has not been published, being a new invention. As I have not seen it tried, I cannot speak of its merits, but must leave you to judge. A A is an oblong frame work of cast iron, with a bearing, C, on each side for the frame, B B, on each side, which is raised or lowered, according to the nature of the earth, by a chain, and the wheel and axle, F; D and E are two wheels, with a chain running round them; D, the working wheel, which digs up the earth as the machine moves along, the irons of which are like the broad end of a pick-axe; the irons of the wheel, E, which makes two revolutions to D's one, are narrower, and are to break up the clods as D digs them up; the wheels, H H and I I, are to run on the ground; the axle of the wheels, I I, works on a centre, J, to allow the machine to be guided like a common four-wheel carriage; K, the frame for the centre, J, to work in; G, the bearing for the wheel, H, with a similar bearing on the other side. The irons on the two wheels are so disposed, that they pass between each other, as at L. The frame, A A, is about five feet long, and the width of it about three feet. The diameter of the axles of the spike wheels is six or eight inches. The machine is drawn by horses as in the old plough.

I remain yours, &c.,

W. SERVICE, JUN.

SPILBURY'S PATENT IMPROVEMENTS IN PAINTS AND VEHICLES, &c.

(Abstract of Specification.)

IN preparing and applying paints or pigments and vehicles, as at present generally practised for painting or coating surfaces therewith, various vehicles are employed; and when it is intended that the pigments or paints should be so fixed as to allow of being cleaned by washing with soap and water, the pigments employed are mixed with oil or spirit, or with oil or spirit varnishes; and it may be remarked, that from the circumstance of employing the above-mentioned vehicles, many of the cheaper pigments, such as earths and others, cannot be used with advantage. And pigments are also often employed mixed with gelatine or size, and known as water-colours, colouring, and distempering; but when such mode of employing pigments is resorted to, owing to the vehicle being soluble in water, the paints, when applied to surfaces, are not so fixed as to allow of washing with water, or with soap and water, as practised when cleaning paints prepared with oils, or spirits, or varnishes produced therewith; consequently, although by such means of employing soluble vehicles, cheap as well as other pigments may be employed, yet, owing to these not being so fixed as to allow of cleaning, such application of paints or of pigments is not suitable for the better class of paintings, nor for the use of artists. We would here, however, remark, that we are aware that it has been proposed to first coat over floors and other surfaces with pigments or paints, combined with gelatine or size, or with paste, and then to apply one or more coatings of drying oils or oils mixed with varnish; but we are not aware of the same having been performed to any extent, or to any considerable advantage. We have thought it desirable thus to call attention to the means of preparing paints or pigments and vehicles, and to the modes of applying the same now known and in use, in order that the peculiar nature of our invention may be readily understood, and distinguishable from previously known means of preparing pigments or paints and vehicles, and of the means of applying them. Now the object of our invention, whether in preparing pigments or paints and vehicles, or in the mode of applying them, relates to means of using soluble vehicles for applying paints or pigments, which vehicles, by an after application of chemical agents or re-agents, are rendered insoluble in water, and will thus allow of paints or pigments so applied and so fixed, to be afterwards washed in order to clean them; and will, at the same time, admit of paints or pigments and vehicles so employed, being applied for the most elegant purposes of house and such like painting, and also to the purposes of the artist, and *for printing paper and other fabrics*; and at the same time in their use they will not emit that disagreeable smell consequent on using oils, or spirits, or varnishes produced therewith, combined with paints or pigments.

In painting, there are few of the colouring matters or pigments used as a single pigment, but they are used as colouring substances to what may be called a body-pigment; and, in most instances, white lead (carbonate of lead) is used when oils, or spirits, or varnishes prepared with them, are the vehicles, and the coloured pigments are mixed therewith, in order to

produce the colour or tint of colour desired, and in the quantity desired. Hence in any mode of compounding pigments for the purpose of being applied as paint, it is important to have a good and cheap white pigment, which can be obtained in large quantities; and we prefer for such purposes sulphate of lime, sulphate of barytes, argillaceous earths (or other white pigments may be used, which should be free from iron), and we compound with the white pigment the coloured pigments, in order to produce the colour or the tint of colour desired, in the same manner as heretofore practised. The invention relating to modes of applying certain well-known chemical actions to the purposes of the art of painting, it will now be desirable shortly to explain, and the principles of action which are brought about in carrying out our invention, in order that the rationale of the working of our improvements may be readily understood. It is well known that many chemical agents or re-agents, when brought in contact with gelatine or with albumen in solution, coagulate them, and such coagulated substances, when dry, are insoluble; and such is the case with other matters hereafter described, which, as well as gelatine and albumen, we employ as the soluble vehicles for mixing with pigments, in order to their being used as paints; and, by the subsequent application of chemical agents or re-agents, such vehicles are rendered insoluble, and the paints or pigments employed fixed or set.

Having thus called attention to the general nature of the invention, we will proceed to be more particular in describing the processes of preparing paints or pigments and vehicles, and of their combination, in order to their being in a proper state to be kept prepared, and allow of being transported from place to place. And we will first describe the process of preparing a white pigment in combination with gelatine, adding such preservative means as will keep the gelatine from decomposition, and thus allow of the same, when mixed and ground with pigments, to keep for a very considerable length of time. When using gelatine as the soluble vehicle, we prefer to employ alum as the fixing means, in consequence of its cheapness, and being, as we believe, the best of the chemical agents, which are capable of rendering gelatine insoluble in water, at the same time we do not confine ourselves thereto; and it should be stated, that as most of the paints or pigments will be found to be more or less acted on by the chemical agent or re-agent employed for fixing or rendering the soluble vehicle insoluble, it is important that the pigment employed should be subjected to the action of the chemical agent to be afterwards used in fixing the vehicle or paint. Thus, supposing the pigment intended to be used be an earth, and the chemical agent alum, then we submit the earth to the action of alum, by mixing and washing it in a cold saturated solution of alum, and subsequently, by repeated washings, to remove the undecomposed alum therefrom; and it will then be in a proper state to be ground up with gelatine and water, in the same way as pigments or paints are usually ground. We employ small pug-mills for the purpose of mixing, and, if for immediate use, it must be reduced to the proper consistence with soft water, and will then be laid on to the surface or surfaces in like manner to ordinary paints, each coat being allowed to dry before another is laid on; and when one, two, or more coats have been applied, according to the desire or judgment of the painter or artist, and is become dry, the same is to be fixed by applying a cold saturated solution of alum, or such other chemical agent as may have been determined on; by this means the paint on the surface will be fixed and insoluble in water. Thus surfaces may be painted in the most finished and elegant manner, and it is only necessary to remark, that in using coloured pigments, they should also be first treated with the alum or chemical agent to be employed in fixing the vehicle as above described, in order to prevent any prejudicial action taking place in respect to the colour and to the pigment itself; which in many cases would be the case, should such pigments be used without preparation, and subsequently brought in contact with the chemical agent used to fix the paint. It will be seen, that so far as the simple compounding or mixing pigments with gelatine, when to be immediately used in carrying out our invention, is similar to the ordinary means now resorted to in colouring or distempering; but it will be found that, in order to carry out our invention in the most finished manner, a much larger proportion of gelatine is required; and we shall hereafter give such information as to the relative quantities, as we have found most advantageous; and our invention, so far as relates to the description above given, consists in the mode of treating the pigments employed with the chemical agent, as a preparatory process before mixing the gelatine, and the important process of rendering the gelatine of the mixture or compound, after the

same is laid on to surfaces, insoluble, by means of alum or other chemical agents; and we would remark, that albumen may be used in place of gelatine or in conjunction therewith; and we recommend the use of albumen for the purposes of the artist, where the cost will not be considered an object; yet for general purposes we recommend gelatine, in consequence of the same being much less costly.

(*To be continued.*)

ON ELECTRICITY.

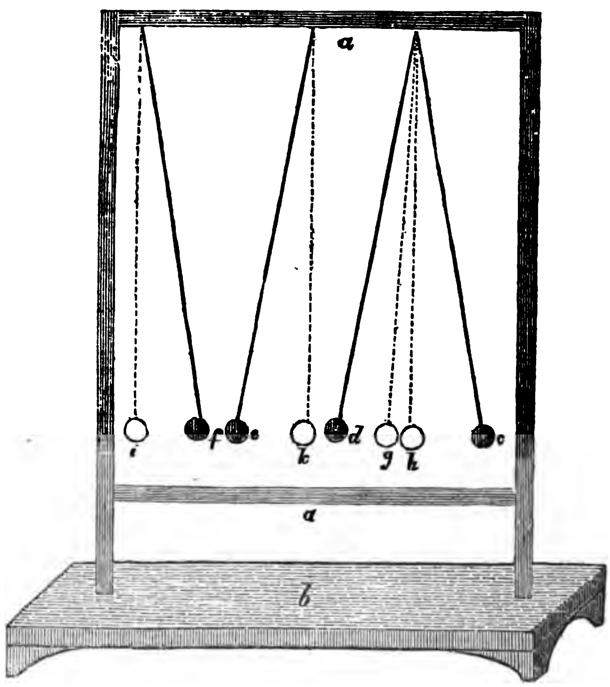
NO. IV.

(*Continued from page* 83.)

The following is the general law of the phenomena of electrical attraction and repulsion—that bodies, similarly electrified, repel each other, and bodies dissimilarly electrified, attract each other.

a a, fig. 1, is a frame of common deal, about four feet by three, supported upon a proper stand, *b*. From the upper cross bar are suspended, by means of fine silk threads,* four pith balls, *c d e f*. It is necessary that each thread be from two to three feet long; at least if I speak from my own experience, I should say so. I found that threads from nine to twelve

Fig. 1.



inches long, which I formerly used, did not insulate sufficiently; and thus I could never succeed in illustrating this phenomena to my own satisfaction. The balls did not sufficiently diverge, and the electric fluid was speedily dissipated. When I used longer threads, however, I succeeded perfectly, and, on this account, would recommend them to others.

If a rod of glass, excited by silk, be brought into contact with the balls, *g h*, fig. 1, they will first be attracted by it, adhere to the surface for a moment, and will then be repelled. Remove the electric: the balls now having each acquired an electricity, similar to that electric, or, in other words, being similarly electrified, will repel each other, and remain in the

* It has been proved by experiment, that silk of a yellow or golden hue possesses the best, and black the worst insulating properties. This appears to depend upon the nature of the dye employed.

position shown in *d o*. The same thing will happen if. instead of using the glass excited by silk, the sealing-wax excited by flannel is used; the balls in this case also tually repel each other.

But suppose the ball, *e*, when in the position shown at *k*, be electrified with the glass excited by silk, and the ball, *f*, when in the position shown at *i*, be electrified with the wax excited by flannel; they will then be seen to attract each other, as is represented in the figure—proving that they are dissimilarly electrified, or, in other words, that the electricity of the silk is different to that of the wax.

"Hence it follows," says Sir David Brewster, "that excited glass repels a ball electrified by excited glass; excited wax repels a ball electrified by excited wax. Excited glass attracts a ball electrified by excited wax, and excited wax attracts a ball electrified by excited glass." Du Fay, who observed this, was of opinion that it arose from there being two opposite kinds of electricity—the one produced by excited glass, which he termed vitreous electricity, the other by excited wax, which he termed resinous electricity. He believed that these two electricities existed together in all bodies; that they attracted each other, but that they were separated by the excitation of an electric; and that when thus separated, and transferred to non-electrics—as to the pith-balls, for instance—the mutual attraction of the two electricities causes the balls to rush together. But there is another theory to account for this phenomena—a theory far more simple and beautiful, and which is, no doubt, in the same proportion, correct. It is the theory of that great man, Dr. Franklin. He believed that electrical phenomena was not the result of two fluids, as Du Fay supposed, but to one fluid diffused over nature in a state of equilibrium; but that as soon as you disturbed the equilibrium of the fluid in any way—if you took away a portion of it from a body, such body was then in a state of resinous, or, what he termed, negative electricity, and that the body to which it was added, was in a state of vitreous, or, what he termed, positive electricity. He supposed, that when glass is rubbed with silk, a portion of the electric fluid leaves the silk and enters the glass, which then becomes positive, and the silk negative; but that when sealing-wax is rubbed with flannel, the wax loses, and the flannel gains electricity; therefore when we electrify one ball with wax, and the other with glass, we give to the former negative, and to the latter positive electricity; and this is just the reason why they attract each other. They are in opposite or dissimilar states; and bodies dissimilarly electrified attract each other. But some person may say, I suppose then, when one ball, having more than its natural quantity of electricity, comes into contact with one that has less than its natural quantity, the one that has much, has the good nature to give to that which has little, and set themselves on equal terms. A very right supposition. When two bodies, the one in the positive, and the other in the negative state, come in oontact, the overplus rushes from the former towards the latter, and the equilibrium is at once restored; and I may as well observe, that this overplus, or what is gained in the positive, is exactly equal, or nearly so, to that which is lost in the negative; therefore it necessarily follows, that when they come in contact, all farther signs of electricity must cease.

(To be continued.)

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(Continued from page 84.)

Coventry returns two members to Parliament; the electors are the freemen, about 3000 in number, and the 10*l*. householders, about 1500, which latter were added by the Reform Bill, the sheriffs being the returning officers. Its charter of incorporation was granted by Edward III. in 1344, and afterwards confirmed and extended by James I. There are four annual fairs, the most important of which was granted by Henry III. It commences on the first Friday after Corpus Christi day, and, according to the charter, is permitted to continue the seven following days. The principal manufactures are ribands and watches. Coventry watches, though distinguished for their good appearance and cheapness, were, till recently, considered inferior to those manufactured in London and Liverpool; they are, however, now much improved, and Coventry may boast of nearly rivalling Liverpool, both for the quality of its watches, and the extent of its manufacture. It is a circumstance worthy of remark, that the manufacture of watches is confined to so few places, that there are none of sufficient importance to be recognised in the commercial world, except the following:—Geneva, Chaux de Fond, and Locle, in Neuchatel; London, Liverpool, Coventry, and Paris; and it is only six or seven years since a regularly established manu-

facture was introduced into the latter place, by the formation of a company, chiefly promoted by M. Arago; previous to that time, the watches reputed French, were wholly, or in part, made in Geneva, or Neuchatel. The higher branches of horology, that is, the manufacture of marine and other chronometers, has nowhere attained that height of excellence which has established, and still maintains the superior reputation of London.

WARWICK is a borough, market, and county town, situated nearly in the centre of the county to which it gives its name; It is 90 miles from London, 21 from Birmingham, 10¼ from Coventry, and 10 west of the railway. It is pleasantly situated on a rocky acclivity, at the foot of which flows the river Avon. The town, agreeable and commodious in itself, is rendered still more attractive by the magnificent castle, and other beautiful structures with which it is enriched.

The castle, which stands on an eminence on the south-east of the town, is considered the noblest relic of feudal grandeur in the kingdom. Its antiquity is so great as to baffle all the researches of historians and antiquaries; but it is clear that it existed before the Norman conquest, and it is supposed that Ethelfrida, daughter of King Alfred, first erected a fortress here; and an artificial mount on the west side, near the banks of the Avon, is still shown as the place where it formerly stood. The walls of the castle at present enclose an area of three acres. For the following description, we are indebted to an interesting volume, "Mogg's Hand-Book for Railway Travellers."

"The approach to Warwick Castle is calculated to produce the most striking effect. A broad and winding path, cut through the solid rock, confines the eye and exercises the fancy, till a hundred long yards are trodden over with increasing expectation. A method of advance so quiet and serene, prepares the mind for a spectacle of unusual character; and unusually grand is, indeed, the object submitted to view. As we draw towards the extent of this rocky path (by the way rendered smooth), three lofty and massive towers rise progressively to the view; and, on proceeding a few steps farther, they stand ranged in an embattled line unspeakably august and commanding. On the left is the tower termed Cæsar's, an elevation, concerning the date of which no trace remains in published or private record. The mode of construction is somewhat rude, and possesses many singularities. Jutting from one side of this tower is an embattled turret of stone, where imagination may place a herald at arms, demanding in a long past century the name and purpose of those so hardy as to advance unbidden. To the right is the tower, named after the fanciful champion Guy. This part of the structure is upwards of 100 feet in height, and was built by Thomas Beauchamp, Earl of Warwick, in the latter part of the fourteenth century. The entrance is flanked by embattled walls, richly clothed with ivy; and the deep moat, now dry in security, its bottom converted into a velvetty path, is lined with various shrubs, and ornamented with some trees of a vigorous and noble growth. The disused moat is crossed by a stone bridge, and the entrance is by double machiolated towers, through a series of passages once big with multiplied dangers for the intruder. In the great court, to which the visiter passes, the display is truly magnificent. The area is now fertile in soft and well-cultivated green sward; but spread around are viewed the mighty remains of fortifications, raised in turbulent ages by mingled ferocity and grandeur. The relics are perfect in outline, and no battlement exhibits the havoc of time, while the hand of tasteful domestic habit has spread a softness over the whole, productive of most grateful relief. We behold with pleasure the ivy bestow pictorial mellowness on parapets and turrets, which must have been only terrifically rugged when manned with warriors in steel, and fresh in early masonry; and broad Gothic windows supplant, with conspicuous felicity, the cheerless single-light, and fatal loophole.

The habitable part of this immense structure lies to the left of the great court; and in the progressive amelioration of feature effected in later ages, every desirable attention has been paid to consistency of character. At the western, or more retired part of the area, is the artificial mount, a vast elevation, surmounted by a portion of ancient building. The walls which range round those divisions of the court not occupied by the residence, are guarded by ramparts; and open flights of stone steps lead to various turrets, and form, with many passages, a ready line of communication through the whole of the fortress. A grand face of the building is displayed towards the river; and here the rock, which affords a foundation to the pile, rises perpendicularly to a considerable height before the stone-work of the superstructure commences. This front has all the irregularity usual in buildings

constructed with a view to security, as well as baronial grandeur; but even this want of uniformity is estimable when considered as a characteristic of antiquity. The windows have experienced some alteration under the direction of the present earl, and much good taste has been evinced in every particular.

The interior of this august fabric surpasses the expectations raised by a view of its outward features; for with the ponderous towers and ramparts of stone, we associate only ideas of chivalric hardihood and unpolished baronial pride. But domestic elegance, and a warm love of the arts, have combined in recent periods to arrange and decorate the halls; yet every effort at fresh and more gratifying modes of disposal, has been carefully made allusive to the antique, castellated outlines of the edifice. The grand suite of apartments extend in a right line 333 feet, and are furnished in a chaste but munificent manner."

(*To be continued.*)

LONDON AND BLACKWALL RAILWAY.

THE trains are propelled to Blackwall by means of two stationary engines, of 120-horse power each, which are worked in shafts sunk into the earth to the right and left of the lines. To these engines, fly-wheels, or, as they are technically termed, "drums," are attached, each of which is of the ponderous weight of forty-four tons, and is twenty-two feet in diameter. A tail-rope is fastened to the drums, which is wound and unwound at each end by the stationary engines, there being also two engines of seventy-horse power each, sunk beneath the Blackwall terminus. As the train proceeds to the latter place, the drums at the London terminus unwind the rope by which the carriages are to be again drawn to London; and to prevent the rope flying across the sheaves in which it runs, too rapidly, and thus becoming entangled in consequence of no weight being attached to it, an ingeniously-contrived break is placed on the platform by the side of the railway, at which a man is employed to regulate the unwinding of the rope. The rope is not an endless one, similar to that employed at the Euston Square station of the Birmingham Railway, but it is in two parts—namely, one for propelling carriages to Blackwall, and the other from that place. It was manufactured by Sir Joseph Huddart and Co., of Limehouse, and cost upwards of 1200*l.* The "drums" take eighty turns to every mile of the ropes, each of which are three miles and a half in length.

The electric telegraph is the next object of attraction, and it is enclosed in a neat mahogany case, that is, so far as it is seen above the ground, and a small bell announces when the train is about to be put into motion. The telegraph is the invention of Messrs. Cook and Wheatstone, and enables parties at each end of the railway to hold conversation with each other with the most perfect facility. At each of the intermediate stations one of the telegraphs is placed, to enable the servants of the railway to communicate with the engineers at the termini; and it was stated, that notice of any impediment or casualty might be given at an intermediate station to one of the termini, and thence conveyed to the other end of the line in the short space of three seconds.

The line proceeds on a series of arches from the Minories to the West India Docks, across the Regent's Canal and the river Lee. The span of the arches crossing the canal and river is from thirty to forty feet, and from the West India Docks the line runs upon an embankment, and the ground falls into a very rapid decline of 1 to 150. So that from the Marsh to the Blackwall terminus, the embankment is but a few inches in height. The difference in the level of the line, from one end to the other, is eighteen feet. The three intermediate stations – namely, the Stepney, the Limehouse, and the Marsh, are exceedingly neat externally, and conveniently fitted up internally for passengers who have to wait for the trains.

The railway is fenced in with a light and ornamental iron palisade, which is materially better than the walls of the Greenwich; as it prevents a reverberation of sound, and, consequently, on the Blackwall Railway, the passengers are not subject to annoyance from a continued and deafening noise. The iron-work also presents a more pleasing view to the eye. The length of the railway at present is three miles and a quarter, and when it is carried on to Fenchurch Street, it will be three miles and a half. The railway was projected in 1828, and the bill passed for its formation from Blackwall to the Minories in 1837. Another Act of Parliament, authorising the Company to extend their works to Fenchurch Street, was obtained in 1839. The estimate of the whole was 600,000*l.*, of which 450,000*l.*, or thereabouts, has been expended. The stationary engines, it was said, cost about 30,000*l.*

The first class carriages are of the usual

description, except that there are no elbows to the seats. The fare to either of the stations will be 6*d*. by the first class, and 3*d*. by the second class. The second class carriages are of the same construction as those on the Manchester and Leeds Railroad, and are termed by engineers "stand-ups," there being no seats to them, and the passengers having to stand during the journey. The weight of the railway carriages is estimated at five tons each, exclusive of passengers.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, July 22, Rev. R. Vaughan, on Ancient Persia. Friday, July 24, F. M. Innes, Esq., on the Present State and Future Prospects of the Australian Penal Colonies. At half-past eight precisely.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, July 22, Mr. H. Wiglesworth, Lecture and Discussion, "Should Circumstantial Evidence be sufficient Grounds for a Jury to convict a Prisoner." At eight o'clock.

QUERIES.

Can new hemp fish-lines (such as are used for catching pike) be prevented from twisting when first used, as new lines invariably twist all up to one knot; and it is not until they have been used several times with much trouble, that they will keep straight in the water? Is there any process to prevent this? M. TURNOR.

How to convert India-rubber into a cement? INQUIRER.

ANSWERS TO QUERIES.

To Prepare Sulphuretted Hydrogen.—Pour dilute muriatic or sulphuric acid over black sulphuret of iron or antimony in a retort: for nice experiments, it must be collected over mercury.

Pyroligneous Acid is obtained by the distillation of wood. Its specific gravity is 1.009. It contains about one-twentieth of its weight of absolute acetic acid. MANIPULATOR.

To Scent Windsor Soap.—The perfume used to scent Windsor soap is oil of cloves.

Waterproof Liquor for Soles of Shoes.—Roche alum, four ounces; sugar of lead, two drachms; powdered gum-arabic, one drachm; water, eight ounces.

Another.—Indian rubber, one drachm; oil of turpentine, six ounces; linseed oil, eight ounces.

TO CORRESPONDENTS.

H. O. P. E.—*The true proportion between the diameter and circumference of a circle is not known: it cannot be discovered by any process at present known. See page* 296, *Vol. IV., where it is given true to the hundred and fifty-fourth place of decimals. Most of his other queries have been answered in recent articles. We are often asked, "which is the best book" on some particular subject, and "where is it sold, and its price?" The publication of such information would subject us to the advertisement duty. We are now asked, which are the best works on algebra, logarithms, and astronomy?—It depends entirely upon the progress the learner has already made. If he has all to learn, he should take Fenning, or any other book that explains those parts of numerical arithmetic which apply to algebraical fractions, &c. It is in vain to attempt to pounce upon astronomy, without the preparatory study of geometry, algebra, &c.; the best books would be unintelligible, and those that are intelligible to the uninitiated, are useless. We know of no better books on these subjects, than those used at Cambridge.. Vince's "Elements of Astronomy" will take the student quite far enough for most purposes.*

J. M. D.—*The brass rings which conjurors appear to link and unlink, have no joints; they are provided with a certain number linked together, and others which are detached. The deception is in substituting one set for the other. The reason of a pendulum being unfit to regulate the motion of an equatorial is, that a continuous and even motion is required, and the pendulum with an escapement, as in a clock, admits only of an intermitting motion, the whole machinery being at rest, or retrograding, according to the construction of the escapement, during a period of every vibration. His suggestions will be attended to.*

An Amateur Chemist.—*The petrifying property of certain springs has been mistaken and misrepresented by some writers. The substances exposed to their action are not converted into stone, but only covered with a stony deposit. (See* Mechanic, *Vol. IV., page* 381.*) In the fossil remains of animal and vegetable organic bodies, decomposition has evidently taken place, and recombination with extraneous matter has succeeded; and this is so evident, that the different parts of a fossil body retain, to a certain extent, the characteristics of their original composition, as may be seen in fossil shells, compared with the animal contained within. The process is of many ages' duration; but its precise nature and rationale, have hitherto eluded the researches and investigations of the chemist. The occurrence of flints in chalk, &c., and, which is still more remarkable, masses of primitive rock on the summits of the highest mountains, has not yet been explained by any rational system of philosophy.*

ERRATA.—Page 83, line 22, for "electrics" read *non-electrics*; and for "non-electrics" read *electrics*. Line 59, for "shock" read *spark*.

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

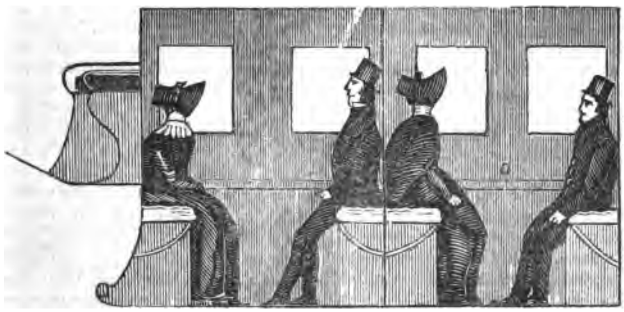
MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 102, NEW SERIES. | SATURDAY, JULY 25, 1840. PRICE ONE PENNY. | No. 223, OLD SERIES.

PATENT OMNIBUS.

FIG. 1.



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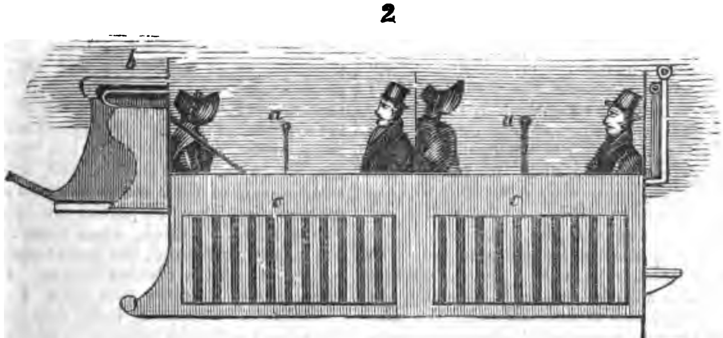

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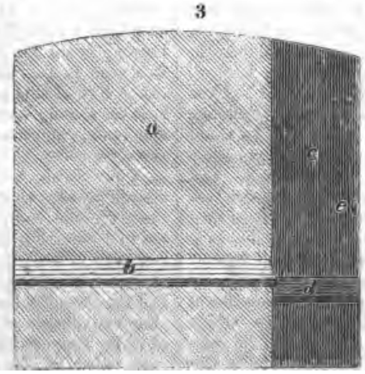


 City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

A FEW REMARKS ON THE PATENT OMNIBUS.

(See Engraving, front page.)

Description of Engravings.

FIG. 1 is a transverse side view; *a a* is a hand-rail passed along the opposite side.

Fig. 2 is a side view of its summer appearance; *a a* are speaking-trumpets; *b* is the coach-box; *c c* are the ventilators.

Fig. 3 is a transverse back view; *a* is the partition; *b* the seat fixed this side of it; *c* is the front of the omnibus. The door behind is of the same size as that part which is seen front in this view; *d* is the seat in the front.

Since, in No. 40 of your last volume, you called the attention of your numerous readers to the construction of the patent omnibus now brought into use on public roads, I take this opportunity of making a few remarks on the alterations described, and then proposing a plan which I consider better calculated to enhance the comfort of those vehicles.

The inventer of the patent says, "One of the chief objections to the common omnibus, is the great inconvenience experienced in passing to and from the seats;" and the danger "of being jolted against the nearest parties, and perhaps thrown down before reaching the seat." This I think somewhat exaggerated, for we seldom find any serious annoyance from this source; and the fall of a person is a thing I never saw, or, indeed, heard of. As, however, it is not always possible to keep the conveyance steady, while parties are getting in and out, the hand-rail, where applicable, is a decided improvement. The next objection he has, I think, greatly magnified; for he states, "that from the risk people run of catching cold, the windows are seldom opened." During the summer months, you rarely enter an omnibus in which some are not down. It, however, cannot be denied, that if the situation of ventilation could be satisfactorily altered, it would be no mean improvement. How far the patent omnibus effects that object, I will not undertake to say. The third objection he mentions, is the impunity with which robberies are effected, and which, he says, is, in a great measure, attributable to the "confusion" occurring when parties are entering or leaving, "and from the general exclusion of light." Now on this ground, at least, I think he has no reason to boast; for the position a seated person must put himself in, when another is getting in or out of the carriage—viz. coiling up his legs under the seat, and slightly turning on one side, will afford an opportunity to that class of gentry, termed pickpockets, for the performance of their silent operations. scarcely ever before offered them; and as there are no persons opposite to observe them, they will certainly not only effect their purpose with greater facility, but also security. The inventer then states, that "many other improvements are made, among which is the indication of the side of the road a gentleman wishes to be set down, by means of bells." The possibility (when accustomed to the bells) of the conductor's forgetting any directions he may have received of a gentleman getting in, and, in consequence, conveying him farther than desired, or the probability of two bells sounding at the same time at a cross street, owing to which, either one person must be put down wrong, or both, to their mortification, set down in the middle of the road—are, I think, sufficient objections to this alteration. The slight advantage of the hand-rail, then, the altered situation of the passengers with regard to the windows, and the communication with the conductor by means of bells, are the only things to weigh against the increased weight and width of the omnibus, the greater facility offered to thieves, the inconvenience of getting in and out, and uncomfortable position of the legs when in; together with the division which must take place, of a lady and gentleman or little party, when there is not room for the whole in one compartment, and the annihilation of that convenience to social conversation felt when parties are opposite one another. I think, when these things are calmly considered, the patent omnibus will be thought a decided failure. I will now briefly describe the plan I have thought of. I propose, then, that the vehicle be of sufficient breadth to admit four persons abreast at the front end, opposite to which a seat for three is to be placed, leaving room for one to pass; the back of this seat is to reach to the roof; on the other side of this partition is to be another seat for three; opposite that again, against the back, must be another seat for the same number. On the outside must be a seat for three, beside the coachman. It should be also so constructed, that (when desired) the roof, half of the sides, and part of partition and back, may be easily removed; thus, in hot weather, rendering it more comfortable for passengers, and lighter draught for horses. For the farther ventilation of the conveyance, a row of thin narrow bars, the spaces between each being of the same width as the bars

themselves, should be fixed all round; behind which should be another row of the same size, moveable for a little way backwards and forwards by the passengers, in the same manner as some of Dr. Arnott's stoves are regulated, the inside bars filling up the spaces of the outside row when required. In winter, to prevent the cold, in addition to the bars being closed, a board might be fastened up against them, with buttons. I think the lowering of the coach-box, and the communication with the conductor being made through speaking-trumpets carried along the sides up the back, would be also improvements. I have also thought of a plan, by which the distracting noise occasioned by the rattling of the windows, which so haunts the omnibuses at present in use, might be prevented; and also a way by which the roof, &c. may be easily removable, in the manner I have described; but these I will not mention now.

I remain yours, &c.

An Admirer.

ON ELECTRICITY.

NO. IV.

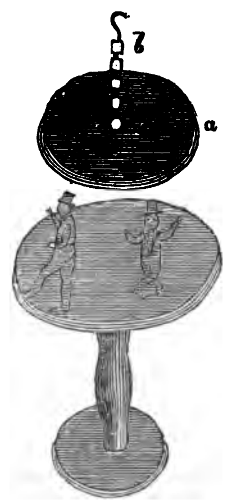
(*Continued from page* 93.)

There are some curious and interesting experiments, which illustrate the phenomena of electrical attraction and repulsion. I will name two or three:—Take a glass tumbler, and electrify it on the inside, by placing it over a pointed wire, projecting from the prime conductor of the machine. When sufficiently charged, place it over about a dozen pith balls, and they will immediately be thrown into violent motion; they will be first attracted by the charged glasses, when, having acquired an electricity similar to that glass, they will be repelled by it. When they arrive at the table, this electricity is carried away, and they are again susceptible of attraction and repulsion. After a short time, however, as the fluid dissipates, the motion will gradually subside, and at last cease altogether.

Here is another experiment on exactly the same principle, only in a different form.

a a, fig. 1, are two round metallic plates; the upper one, when about to be used, is suspended by means of the chain, *b*, to the prime conductor of the machine; the lower one is supported on a proper stand, and communicates with the ground. Between these two plates (which are from six to twelve inches apart, according to their size, and the power of the machine) place two or three figures, cut out of cork or the pith of elder, and as soon as the machine is turned, they will assume an animated appearance, being first attracted and then repelled. This experiment is the more interesting, as there is no apparent cause influencing their movements; but they appear to dance as if by magic. Had such a thing been known at an earlier day, the experimenter would, doubtless, have been burnt at a stake, or boiled in a cauldron for witchcraft. What an influence has education had in purging us from such superstitious enormities!

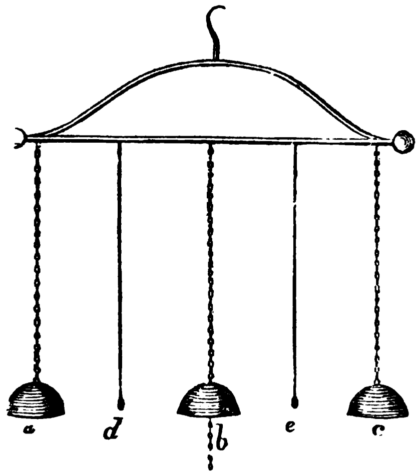
Fig. 1.



The electrical bells furnish another pleasing illustration of the attractive and repulsive properties of the electric matter. The two outer bells, *a c*, fig. 2, are suspended by metallic chains. The two clappers, *d e*, and the inner bell, *b*, by silk threads. The bells being attached to the machine when in action, the electricity passes along the chains, being conductors to the outer bells; but will not pass along the silk, being an insulator to the clappers or inner bell. The outer bells being thus charged with electricity, attract the clappers; but as soon as they come in contact, they are repelled with sufficient force to cause them to strike against the inner bell, upon which they deposit their electricity, and are again attracted. By this means a constant ringing is kept up, while the machine is turned. From the inside of the middle bell, a chain passes to the ground, for the purpose of carrying off

the extra quantity of electricity deposited upon it by the clappers.

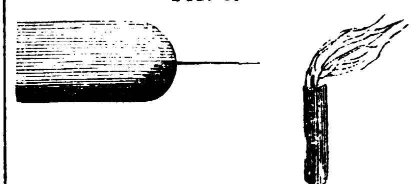
FIG. 2.



If the figure of a human head, covered with hair, be placed upon the prime conductor of the machine and electrified, the hair will stand on end, each filament appearing as if it avoided the other, and will present a frightful appearance. This arises from their being similarly electrified, and, therefore, each repels the other.

In the formation of electrical apparatus, great care should be taken that every instrument be as smooth and round as possible; for it is a curious fact, that the power of retaining electricity in a body, is very much influenced by its shape. A sphere and a cylinder, with a hemisphere at each end, as the prime conductor of the machine, for instance, are the best forms for its retention. But this fluid escapes in a surprising degree from every pointed body. From the ball of the prime conductor, when the machine is in action, a strong spark can be obtained; but a great difference will be observed, if one or two finely-pointed wires be placed in the holes of the conductor; we can then elicit very feeble symptoms of electrical action, the fluid being carried away by means of the point. And it not only possesses the power of dissipating or carrying away the electric fluid, but likewise of collecting it; and this is the reason why we attach a row of points to the conductor of the machine on the side nearest the cylinder, as electricity is collected more speedily in bodies of this shape than in any other. If I were to place my hand over this point when the machine is in action, I should feel a current of air rushing against it, which depends upon the mutual repulsion of the different particles of the air, causing each rapidly to recede. It is termed the aura electrica, and is sometimes used for medical purposes. In the dark, it has the appearance of a brush or pencil of light. If a candle be placed in the vicinity of this current of air, it will act upon it, in the same way as when it is put in motion from any other cause. The following is a representation.

FIG. 3.



Seeing, then, what an effect every point has in carrying away the electric fluid, every one will easily perceive how absolutely necessary it is, as I before hinted, to have all electrical apparatus as free from asperities, or nearly round, and in as polished a state as possible. Is there any young experimentalist who reads these lines, that would like to try his skill in making his own apparatus? listen to the remark which I have just made; and let me tell you, my young friend, that if you wish to succeed, you must avoid, as you would a serpent, all sharp edges and corners.

SPILBURY'S PATENT IMPROVEMENTS IN PAINTS AND VEHICLES, &c.

(Abstract of Specification.)

(Continued from p. 92.)

WE will now describe such mixtures or compounds as we have found to answer, and believe will be found to be the best.

Preparation of Paint or Pigment when desired to be kept.

White Paint.—Take 160 pounds of sulphate of lime, or sulphate of barytes, or white earth, well washed, in order to separate all foreign matters, as is well understood, and which has been treated with the chemical agent, as above explained; mix therewith about twenty pounds of solid gelatine, and about fourteen pounds of sulphate of zinc (or other

suitable material to preserve the gelatine from decomposition, may be used), dissolved in 160 pounds of warm water. The state in which we prepare this compound, is that of very thick paste, which we pack in small casks, or the compound may be dried with or without sulphate of zinc or other preservative; or the dry pigment may be prepared or mixed with dry gelatine or dry albumen; but we prefer the semi-fluid or very thick pasty state, which is a very convenient one for transport. It should, however, be remarked, that if albumen be employed, sulphate of zinc is not to be used. We would remark, that we do not claim the application of sulphate of zinc, or any other of the known modes of preserving animal matter from decomposition generally, the same not being new in itself; and we only employ such mode or modes when compounding pigments with gelatine, or when preparing gelatine for the purpose of being used in compounding paints and pigments, in order to preserve the gelatine, that the prepared pigments and vehicles may be transported from place to place, and keep good for a considerable length of time. The use of sulphate of zinc, otherwise improves the quality and increases the durability of the paint when applied. It should be stated, that the means of preserving gelatine heretofore most generally practised, in order to its keeping for some time, by sulphurous acid, acetic acid, and alum, are not proper for the purposes of our invention, and, therefore, are not to be used; but in employing preservatives with gelatine, it must be done in reference to the fixing process, or after application to surfaces as herein described; and we use, by preference, sulphate of zinc, or other soluble salts of zinc, the soluble salts of magnesia, and the soluble salts of lead. In case the pigment is to be tinted or coloured, then the white pigment employed is to have coloured pigments combined, or intimately mixed therewith, in order to produce the tint of colour desired, *unless the coloured pigments by themselves are to be employed*, which is seldom the case in colouring or painting; and such coloured pigments are to be first treated with a cold saturated solution of alum, or other material, to be afterwards employed in fixing the soluble vehicle, by rendering it insoluble. It may be desirable to remark, that we have found that some specimens of pigments have not required any previous preparation, while others from the same place have been prejudicially acted on, when used without previous preparation or treatment, by the chemical agent to be afterwards used; under these circumstances we have found it desirable, as the trouble and cost is but small, to prepare all the pigments we employ, by first subjecting them to the action of alum, or other material to be used afterwards in fixing, by rendering the vehicle employed insoluble. And we would remark, that the mere rendering gelatine and albumen insoluble by alum or other known chemical means, forms no part of our invention; and as the chemical agents which so act, are known to chemists, and as we, in carrying out our invention, have, as before described, used alum when gelatine or albumen is used for the vehicle, and believe it to be the best for the purpose; we have not thought it necessary to enter more at large into the chemical matters, which are capable of rendering gelatine and albumen insoluble; yet as other persons may consider it desirable to employ other chemical agents, we recommend, that whatever be the agent employed, the pigment and vehicle should be tested by it, by applying a small quantity of them to a surface, in order to ascertain whether it will retain its property of fixing, and not have any prejudicial action in respect to the pigment or vehicle, when combined, or to the colour thereof.

Another part of our invention relates to a like mode of employing other soluble vehicles for pigments, in which the vehicles are to be afterwards rendered insoluble by alum, or other known chemical re-agents; and this part of the invention relates to the employment of resinous matters dissolved in a solution of borax, or in an alkaline ley; and this part of the invention also relates to the employment of wax dissolved in an alkaline ley.

As an example of the former, we take well-bleached shell-lac, and combine it with borax, in the proportion of about five pounds of the former to one pound of the latter. These are boiled until dissolved, in about four gallons of water; with this vehicle, the pigments required are to be ground to the proper consistency of paint, which is to be laid on in the usual way, one or more coats, as required; and, when dry, it is to be washed over with a solution of alum, or other chemical agent, which is known to destroy the combination of the lac and the borax, rendering the lac insoluble.

(*To be continued.*)

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(*Continued from page* 95.)

"The Hall is a noble room, sixty-two feet long, and thirty-seven feet wide, paved with black and white stone, and wainscotted. Various weapons and pieces of armour, interspersed with antlers, are attached to the sides. Piled round the wide fire-place are logs of wood, in attention to the usage of the ancient barons' household, in which establishment convenience was ever studied in preference to delicacy. But the hall is, properly, the only apartment devoted to so strict a *keeping* of manners. The sides of the *antechamber* are panelled, and edged with gilt moulding; the floor is of polished oak.

The Cedar Drawing-room is of large proportions; the floor is of polished oak, the sides, lined with cedar, are well carved; the ceiling is highly ornamented, and the furniture superb. The *Gilt Room* is richly embellished. The *State Bedchamber* is hung with curious tapestry, worked at Brussels in 1604. The costly bed-furniture belonged to Queen Anne, and was given to the late Earl of Warwick by King George III.

The *Dining and Breakfast-rooms* are also charming apartments. A valuable collection of family portraits, and other pictures of distinguished merit, are judiciously distributed throughout the different rooms, the gallery leading to the chapel, and principal passages.

The *Gallery of Armour* contains a fine collection of old English mail. The *Chapel*, approached by a gallery, though not large, is of a sedate and decorous character. The windows of each room in the grand suite command diversified and lovely prospects. To the right, the river Avon winds through a long expanse of decorated park scenery. On the left, various objects intercept the view, but all are consonant and picturesque.

The *Park* attached to this noble castle, is very extensive, and finely adorned by wood and water. The garden grounds, or home domain, are arranged with the exquisite order of taste that has its basis in simplicity. A broad gravel walk, of devious progress, conducts through these grounds, and is embowered by a rich variety of evergreen foliage. Different vistas, designed with great judgment, afford fine views of the castle, the windings of the Avon, and principal features of the surrounding country. In a conservatory, erected for the purpose, is deposited a very large *antique vase*, presented to the Earl of Warwick by the late Sir William Hamilton. This magnificent antique is composed of white marble, and is of a circular form. The decorations consist of Bacchanalian emblems, finely executed; and from the body of the vase proceed two handles, formed of interwoven vine-branches. This vessel is calculated to contain 163 gallons.

The lofty artificial mount on the west of the castle, is now ascended by a spiral path, skirted by protecting trees and shrubs. At an advanced point of the ascent is a turret, approached by stone steps; but on the summit of the elevation, supposed to have been formerly crowned with the gloomy residence of the lady of the Mercians, a large fir waves its broad branches in pensive but grateful triumph.

In one of the rooms attached to Cæsar's Tower, are still preserved the sword, shield, helmet, &c., ascribed to the legendary champion, Guy. The reader will scarcely need to be informed, that this personage is reported to have been an Earl of Warwick, who fought with and slew a gigantic Dane, by name Colebrand. After this duel, he is said to have retired to a hermitage, on the secluded and romantic spot since named "Guy's Cliff," where he died and was buried.

During the civil war of the seventeenth century, the town of Warwick suffered severely from the active part taken by Lord Brooke in public affairs. The castle was now rendered a depository of arms, and placed in a regular state of garrison. This stronghold at one period of the war sustained a siege, and several skirmishes occurred in the neighbourhood. Nor were the more ancient seasons of freedom from personal danger productive of entire tranquillity to the inhabitants; for when relieved from the appearance of professed foes, they were continually harassed by the visits of armed throngs, who were only preferable to the enemy because they drained the householder's purse and board without holding a sword to his breast.

In the year 1694, Warwick experienced the calamity of a dreadful fire; when the greater part of the town, including the High Street, and nearly the whole of St. Mary's Church was consumed. The loss sustained on this occasion has been variously estimated: it was computed at the time to amount to 96,000*l.*; but it is said that 120,000*l.* were employed in repairing the damage. The sum of 11,000*l.* was collected by brief, to which Queen Anne munificently added 1000*l.* as a royal gift. This affliction, like all others of a similar

nature, though bitterly severe to the inhabitants of the period, was productive of great local improvement; and we may safely assert, from the aspect of those parts of the town which escaped the conflagration, that the place is entirely indebted to its temporary misfortune for its chief domestic ornament. But although the buildings were improved in size and character, when the town was thus restored, the principal streets were originally disposed with considerable regularity.

The principal church is dedicated to St. Mary. Although this building has no pretensions to beauty, it is still firm and capacious. At the west end is a square tower, the height of which, from the base to the top of the battlements, is 130 feet. Between the piers supporting the tower, a passage is wrought, allowing the transit of carriages. The church is of a cruciform description. The extreme length is about 186 feet; the breadth, 66 feet. The cross aisle measures 100 feet 6 inches. The interior is rendered august by the remains of the ancient structure. We here view the choir, untouched by the ravage of the flames, and stand with reverence amid the memorials of a family, conspicuous in national history. On each side are ranges of stalls. The stone ceiling is finely designed and delicately worked. Among the chaste, yet ample and elegant embellishments, are introduced the arms of the founder, and his arms quartered with those of his wife embesomed by seraphims. In the middle of the choir is the altar tomb of Thomas Beauchamp, Earl of Warwick, and his lady, Catherine, the daughter of Roger Mortimer, first Earl of March. On the tomb are the recumbent effigies of the persons interred. The earl's figure is in armour, and his right hand clasps the right hand of his countess, whose left is on her breast. On the sides and ends of the tomb are thirty-six figures, representing the closest relatives of the deceased earl, with coats of arms beneath. These figures, usually termed *weepers*, curiously exhibit the peculiarities of dress prevailing at that period."

RICHARDSON'S SAW.

To the Editor of the Mechanic and Chemist.

SIR,—In your notice to correspondents, I find in No. 99 an application to know my address by a Mr. Barry. I should feel happy to give him the information he requests, but would rather defer it for about two months, when I shall be able to state what the machine will do by actual practice on a larger scale, being now engaged in fitting it up for work. I am also trying an experiment to drive the same, together with a lathe and a circular saw, by a set of wind-sails, without any toothed gear at all. I do not think I can possibly get it at work before the end of September.

CHARLES RICHARDSON,
Builder.

Godalming, Surrey.

MISCELLANEA.

To Manufacture Small Models of Balloons.—Now that the season of the year has arrived, when possibly some of your juvenile subscribers will amuse themselves by manufacturing small models of balloons for experiment or amusement, I extract for their information from the *Encyclopædia Britannica and Londinensis*, a few particulars which, perhaps, may be serviceable to them:—

"White smoke, produced from burnt straw and small wood, is one-third lighter than the common air.

It is the union of heat and moisture that gives to air its greatest expansion..

One cubic foot of air weighs 554 grains, and expands one-five-hundredth part of its bulk for every degree of heat added to it.

Five hundred cubic feet of air obtain an ascensive power of one ounce for every degree of heat added.

A balloon of ten feet diameter will raise twelve pounds, independent of any weight. One of 50 feet will raise 1562 pounds, and one of 100 feet, 12,500 pounds.

Measure for Balloons and other Spherical Bodies.—The diameter of a circle is to its circumference as 7 to 22.

To ascertain the superficial measure or extent of surface, multiply the diameter by the circumference.

To find the capacity or the number of feet of gas or air it will contain, multiply one-sixth of the surface by the entire diameter, or take $\frac{11}{21}$ of the cube of the diameter.

An excellent Varnish for Tissue Paper to be used for gas balloons, is made by adding two parts of drying linseed oil to one of the solution of India-rubber, and mixing them by means of heat. To be applied warm, and on both sides of the paper."

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, July 29, Rev. R. Vaughan, on Ancient Persia. Friday, July 31, F. M. Innes, Esq., on the Present State and Future Prospects of the Australian Penal Colonies. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street. — Thursday, July 30, B. R. Haydon, Esq., on the Principles of the Human Form. At half-past eight.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, July 29, a Lecture on Phrenology. At eight o'clock.

QUERIES.

The simplest method of constructing a small force-pump for a fountain? A. S.

What are the ingredients used for making the compo-ornaments for picture-frames, or something that, when taken from the mould, will allow of being bent in any required direction? What I want them for is the interior decorations of the ceiling of our church, being myself the contractor for that work. C. Richardson.

ANSWERS TO QUERIES.

Oil of Ben is extracted from the ben nut by gentle pressure; it will not grow rancid by keeping. Its specific gravity is 0.917.

Oil Paper for Paste Blacking may be made by brushing over paper with drying linseed oil, and allowing it to dry.

Lactucarium or *Lactucine* is extracted from the lettuce, and is narcotic in its medicinal properties.

Blacking Recipes.—Lamp black, six pounds; sugar, six pounds, dissolved in two pints of water; sperm oil, one pound; gum-arabic, three ounces, dissolved in two pounds of vinegar; vinegar, three gallons. Mix; then add gradually one pound and a half of sulphuric acid.

Or, ivory-black, three-quarters of a pound; treacle, three-quarters of a pound; sperm oil and sulphuric acid, of each three ounces; vinegar four pints. Mix.

Or, ivory-black and treacle, of each two pounds; neat's foot oil, eight ounces; sulphuric acid, one ounce; gum tragacanth, two ounces; vinegar, six pints. Mix.

Or, ivory-black, six pounds; vinegar and water, of each two gallons; treacle, eight pounds; sulphuric acid, one pound. Mix.

Or, ivory-black, one ounce; small beer or water, one pound; brown sugar and gum-arabic, of each half-an-ounce; and, if required to be very shining, the white of an egg. Mix.

Polishing Powders.—Mercury with chalk (the hydrargyrum cum creta of the chemists), one ounce; fine whiting, four ounces.

Another.—Putty powder (an oxide of tin) and burnt hartshorn, of each eight ounces; fine whiting, one pound.

Fumigating Pastiles.—Benzoin. two drachms; cascarilla bark, one drachm; myrrh, half-a-drachm; oil of nutmeg and oil of cloves, of each fifteen drops; nitre, one drachm; charcoal powder, one ounce and a half; mucilage of gum-arabic, a sufficient quantity.

To make Lemonade.—Mix one part of citric acid with six of powdered loaf sugar. A very fine dry lemonade is thus prepared, which will keep for any length of time The quantity to be used for a glass of water, must be regulated by the taste of the person using it. If it should be required to effervesce, add a half part of carbonate of potass.

To make Crimson Fire.—Dry nitrate of strontia, forty parts; flour of sulphur, thirteen parts; chlorate of potash, five parts; sulphuret of antimony, four parts, and a little powdered charcoal. The ingredients should be separately powdered, and then mixed, adding the chlorate the last.

Bengal Lights are composed of six parts of saltpetre, two of sulphur, and one of sulphuret of antimony; or seven of saltpetre, two of sulphur, and one of sulphuret of antimony; or, eight of saltpetre, four of sulphur, and one of sulphuret of antimony.

Green Fire.—Dry nitrate of baryta, seventy-seven parts; sulphur, thirteen parts; chlorate of potash, five parts; charcoal, three parts; metallic arsenic (powdered), two parts.

Yellow Fire—Nitrate of soda and chlorate of potash, of each two parts; sulphur and charcoal, one part.

To make a Jet of Red Fire.—Take fifteen parts of mealed powder, and four parts of dry nitrate of strontia.

Jets of other Colours may be produced by substituting the proper "colouring salt" for the nitrate of strontia, as nitrate of baryta for green, and nitrate of soda for yellow.

For a Jet of Blue Fire, use mealed powder, four parts; nitre, two parts; sulphur, three parts, fine zinc filings, three parts.

TO CORRESPONDENTS.

F.—*Photogenic drawings upon paper may be made to show the lights and shades in their proper places, by producing a picture on thin transparent paper, and applying that picture to another prepared paper, and exposing them to the action of the sun. See No.* 16, *N.S., of "Mechanic."—The "Air Light" is noticed in Nos.* 105, 108, 111, *and* 118, *O. S., of the "Mechanic." It is a contrivance to burn the* vapour *of a combustible fluid; it produces a brilliant light, but is attended with much inconvenience, and has not succeeded. If any convenient process could be discovered to separate the oxygen from the azote in atmospheric air, or from hydrogen in water, the great problem of producing good and cheap light would soon be solved.*

R. L. *will receive a letter by post.*

A Subscriber *has our thanks for pointing out an error which appeared in a recent No. It was stated, that objects viewed through the Stanhope lens, should be placed on the* least convex *side of the glass; it should have been the* most convex *side.*

A letter directed to Mr. W. H. Hewitt, *still remains at our Office.*

Several correspondents not noticed in the present Number, will be attended to next week, or as soon after as possible.

London: Printed at "The City Press," 1, Long Lane, Aldersgate, by D. A. Doudney (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. Berger, Holywell Street. Strand; and may be had of all Booksellers and Newsmen in Town and Country.

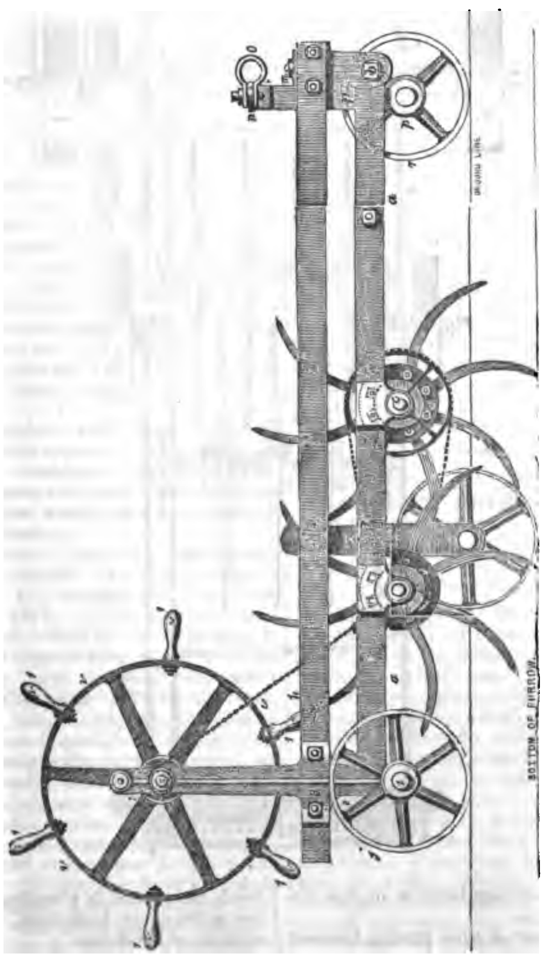
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 103, NEW SERIES. | SATURDAY, AUG. 1, 1840. PRICE ONE PENNY. | No. 224, OLD SERIES.

VAUX'S PATENT REVOLVING HARROW.



The Letters in the Engravings are intended to elucidate the specification of the Patent. A Copy of the Specification will accompany the License.

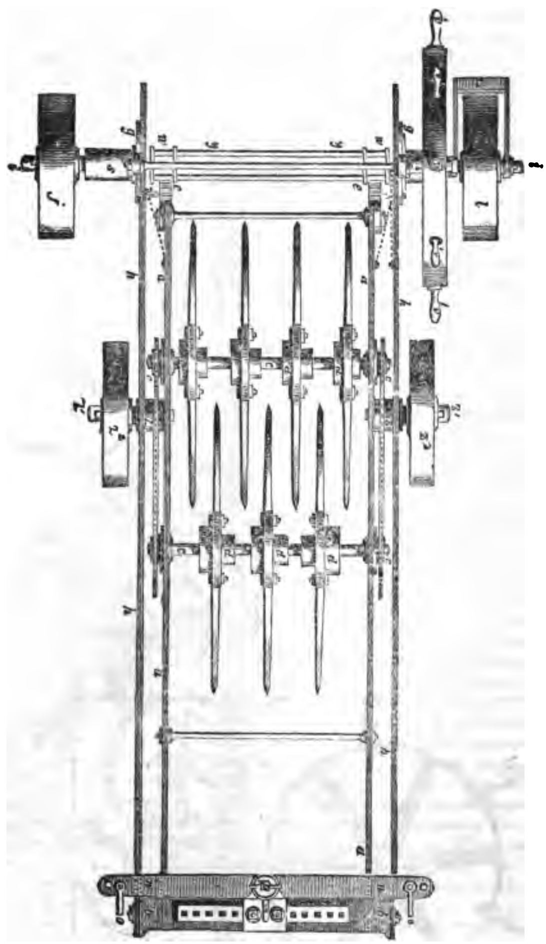
City Press, 1, Long Lane, Aldersgate Street: D. A. Doudney.

VAUX'S REVOLVING HARROW.

To the Editor of the Mechanic and Chemist.

SIR,—Feeling assured that you are anxious, not only to furnish the most useful information in your power, but to do it as correctly as circumstances will admit, I consider it a duty I owe to you and to myself, to supply the means of correcting some *errors* which your correspondent has fallen into in the drawing of my "Revolving *Harrow*," as well as to correct the letter-press accompanying it. With this view, I beg to forward a drawing of it, and prospectus; and to state that, should you consider it worthy of farther notice, I will supply the necessary information.

I am, Sir,
Your most obedient servant,
THOMAS VAUX.



The important peculiarities of this implement consist—

1st. In each set of tines passing between the other set, and clearing each other of couch-grass, &c.

2nd. In the tines descending the full depth the ground is ploughed; and having two actions, one horizontal, and the other circular or revolving.

3rd. The perfect manner in which it pulverizes the ground, at the same time leaving it as light as it is left by the

plough; for it will be perceived from the drawings, that no substance can escape unbroken larger than the distance at which the tines are from each other when in action, while passing each other.

4th. Separating the couch-grass from the earth, *and raising it to the surface.*

5th. Not requiring to be lifted up to get rid of the couch-grass, &c., as is the case with the drags and harrows now in use. Two defects arise from this lifting up;—First, the manual labour required, the want of which, in due time, creates both an extra quantity of animal labour, and causes the work to be executed in a very imperfect manner, occasioned by the tines being choked with couch-grass. Secondly, the land either entirely or partly escaping the action of the tines when being lifted up for the purpose of getting rid of the couch-grass, and mould too, if the land be not quite dry. In addition to these defects in the old implements, especially after or upon the first ploughing, in strong soils in particular, and on light soils if there be much couch-grass, the tines do not penetrate the full depth that the ground is ploughed; so that it is only after the second and other ploughings, several draggings and harrowings, that these implements do what the revolving harrow performs in the first and every other instance—penetrate quite through the furrow-slice.

6th. The facility with which the tines of the revolving harrow are thrown out of action while turning on the headlands, and for the purpose of travelling from one field to another, are too obvious to require farther explanation.

As to the size, it may, with advantage, be made any breadth, from eighteen inches to five feet; any breadth less than four feet will, however, only be used on particular occasions—that is, when the land is too wet for horses or oxen to travel on the surface. On such occasions, one about eighteen inches wide will be the best, which is so constructed, that it operates upon the newly-ploughed furrow-slice, while the horses walk in the furrow; effected by drawing from the left side of the front or head-piece of the frame, with a cock or shackle similar to those used for ploughs, by which, and with the aid of a wheel attached to the inner frame, which travels in the furrow, the tines are made to operate exactly upon the furrow-slice. This wheel also prevents the tines descending deeper than the plough has gone, while the weight of the harrow causes the tines to penetrate exactly through the furrow-slice, but not deeper. With the harrow in this form, land may be pulverized and cleared of couch-grass (which is the object of all tillage), when so damp that neither the one nor the other could be otherwise accomplished. In fact, land may be completely prepared for seed before a commencement can be made with the common drags and harrows. By attaching a rake, or a small common harrow, to the hind cross-bar, and by picking or raking off the couch immediately after the harrow, a complete fallow may be made without either man or beast setting a foot on the newly-tilled part, and the ground left as light as it is by the plough; while, if in the damp state here alluded to, it were worked with the common drags and harrows, it would be poached, or left *sadder than before it was ploughed;* advantages that will be appreciated by no class of farmers more than by those who raise large quantities of potatoes, mangle-wurzel, Swedish turnips, &c., for which the ground requires tilling long before it is sufficiently dry.

In consequence of the small quantity which *this* harrow is capable of tilling, as compared with a larger, it will only be used when land is not in a fit state to receive the tread of horses; probably, with the exception of land in a very foul state, by acting upon so small a quantity at once, it may be more effectual than a larger.

(*To be continued.*)

SPILBURY'S PATENT IMPROVEMENTS IN PAINTS AND VEHICLES, &c.

(Abstract of Specification.)

*(Concluded from p.*101.*)*

As an example of the second vehicle, we take a ley of caustic soda, specific gravity 1.04, to which we add an equal weight of white wax. This mixture is boiled several hours, adding half-a-gallon of water to every pound of wax, after the solution is effected; and we prefer to add four pounds of dry starch, calcined or uncalcined, to each pound of wax; to this vehicle is to be added as much of such pigments, which by previous test are not acted upon prejudicially by an alkaline solution, as shall bring it to the consistency of honey. Reduce this mixture to a proper state for painting, by the addition of soft water, the softer the better; and when the surface painted with it is dry, wash over, as before, with a solution of alum, or other chemical agent, which is known to destroy the combination of

wax and an alkali, leaving the wax insoluble in water. It is obvious that the above vehicles may be used in combination with each other, as well as separately.

Another mode of employing gelatine, and the other vehicles described, for fixing paints or pigments, is to apply a coating of either of the vehicles, over a painted or printed surface, and then subsequently fixing the vehicles by a chemical solution, as above described; by this means paints or pigments may be set, without the necessity of putting the above-mentioned vehicles in the paint or pigment, before using the same.

Another form of our invention is, to mix pigments with sulphate of zinc, or other preservative material, as described above, but without any vehicle, directing the painter to supply the necessary gelatine; the object of this mode is, to enable the mixture with gelatine, when made, to keep a reasonable time in hot weather, at the same time, that not being mixed till wanted, the pigments can be kept an unlimited time. This mode of preparation is particularly applicable for hot climates.

We would in conclusion remark, that we believe the best vehicles to be employed, are gelatine and albumen, and, as above stated, that the best chemical agent known for rendering the soluble vehicles herein described insoluble, is alum.

It may be desirable to state, that pigments and vehicles, treated according to our invention, are applicable in *printing and painting paper and other fabrics, as well as other surfaces*, using pigments and vehicles according to our invention, in place of pursuing the means heretofore resorted to. And we have found, that in using a solution of alum as the fixing material, that it is desirable to apply a small quantity of dissolved starch (say a hundredth part of the solution), by which the same will work better, and not be liable to run when laying it on.

Another part of our invention relates to a mode of applying certain vegetable matters in the preparation and application of paints or pigments. For this part of our invention, the glutinous or adhesive products of vegetable matters generally will do, but we prefer gluten, albumen, gums, mucilage; these may be used either separate or in combination with other products usually found therewith. For example, we take flour mixed with water in such proportions as to form, when boiled, a mixture about the consistency of cream, with this liquid the pigment is to be ground to the state of paint, with or without sulphate of zinc or other preservative, as described in the preceding part of our specification. This paint or pigment, if necessary, is to be reduced with water, and is to be laid on in the usual manner, and when dry, may, according to our invention, be fixed by an application of a suitable chemical agent or re-agent. We prefer silicate of potassa or of soda, commonly called liquor of flint, or other chemical agent, known to render such vegetable products insoluble in water; and we would remark, that we dilute the liquor of flint as much as possible, so long as the liquor will have the desired effect of fixing and rendering the paint on the surfaces insoluble by water; which is readily tested, by laying a small quantity of the pigment or paint prepared with a soluble vehicle intended to be used, and, when dry, by applying the liquor, and letting the same dry for forty-eight hours, when, by washing the surface, it will be seen whether the strength of the liquor used has been sufficient; and if so, the same strength of liquor will do for the same pigment or paint, and vehicle.

We will give another mode of carrying out this part of our invention with effect:—We take any quantity of dissolved tragacanth, of the consistency of linseed oil, which we mix with as strong a solution of silicate of potassa or of soda, which, by previous test, is not found to injure the colour to be employed; with this mixture the paint or pigment is to be brought to a proper consistency for working, and then applied, in the usual way, to surfaces; and, when well dried, the same will allow of being washed and cleansed, owing to the paint on the surface being insoluble in water.

REMARKS ON FRENCH HOUSES AND VENTILATION.

That there are comfortable and weather-tight houses in France, both public and private, cannot be denied by the most fastidious judges of comfort; but, that 999 out of every 1000, throughout the country, are neither comfortable nor weather-tight, is a fact equally indisputable. There is one feature in the construction of them, indeed, which militates against comfort, and that is, the absurd practice of making windows on each side of the rooms where the houses are single; so that, independently of the inconvenience of what is called a cross-light, very annoying to the eyesight, and causing a constant draught of cold air in the winter, there is little respite from the piercing rays of the sun

in the summer solstice. If denied admission on one side, he is sure to make his appearance on the other; so that a cool room, under such circumstances, is not to be looked for at any hour of the day in the dog-days. But, in double houses (which, I am happy to say, mine is), the windows will rarely resist a storm of beating rain; and as to being anything like air-tight, that is not to be expected from their construction and materials. Then the glass is so thin (but it is cheap), that a friend of mine, residing here, declares the wind finds its way through it; and I see no reason to doubt its doing so. There is one security against beating rains and driving snow, in French houses, which is worthy of imitating in all exposed situations, and that is, the open-barred outside shutters to all the upper windows. Neither are they merely a security against bad weather—they contribute to the safety of the inmates, and would be desirable safeguards to all low houses in England, situated apart from others, and, consequently, less secure. And yet, with all these cracks and crevices in windows and doors, together with the uncalled-for number of the latter, I think the French do not take so much pains to ventilate their apartments as we do in England; and, even with us, more would be desirable. Step into the inner apartment of a French shopkeeper, and you are at once convinced of the truth of my remark, and also of that of Mrs. Hamilton, in her amusing tale of "The Cottagers of Glenburnine," that air is a luxury only understood by the better orders. Thus she makes the old Scotch dame remark, with satisfaction, that the air can never "have *won* into her sleeping-apartment." Did people, however, put the proper value on ventilation of apartments, as regards health, it would be more attended to than it is; of which the following fact is a proof:—Some years back, no less a number than 2914 infants, out of 7650, died in the Dublin Lying-in-Hospital, in the space of four years, within a fortnight after their birth! It was discovered that this circumstance arose from the want of a sufficient quantity of good air. The hospital was therefore completely ventilated, and the proportion of deaths was reduced to 279; so that out of the 2,944 who had perished in the four preceding years, no less a number than 2655 had perished, if not solely, nearly so, from the foulness of the air; in my own experience, I can speak to the good effects of ventilation. I have been nearly forty years a housekeeper, without ever having had anything like a malignant disease in my house. I attribute this blessing, in great part, to a rigid observance of my orders, that bedroom-windows (others of course) should be left open the greater part of the day, in all seasons of the year; that no bed should be made for at least three hours after it has been occupied; and that, previously to its being made, all the clothes belonging to it shall be exposed, separately, to the air. Nothing is more likely to produce disease than beds made before they become cool and well-aired.—*Nimrod in France.*

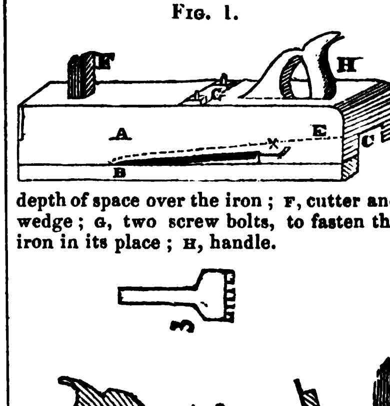
MOSS'S MATCH-PLANE.

To the Editor of the Mechanic and Chemist.

SIR,—In your valuable Magazine, I see that a correspondent "S. G. H." in Vol. VI., No. 1, wishes to know how Lucifer matches are cut. I made a plane for cutting them, which answers exceedingly well, and with which I could cut 500 or more per minute by manual labour. The length of wood I find the best to cut, is eighteen or twenty inches long, and two inches thick, which can be cut easily; the matches dropping out in shreds behind, which can be cut to any length required.

Description.—Fig. 1, A, side; B, fence screwed on; C, end from where the matches come, after being cut; D, position of the iron; E, dotted line, showing the

FIG. 1.



depth of space over the iron; F, cutter and wedge; G, two screw bolts, to fasten the iron in its place; H, handle.

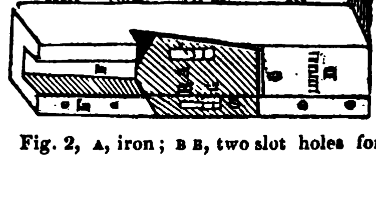


Fig. 2, A, iron; B B, two slot holes for

screw bolts; C, mouth; D, cutter; E, space for matches; F, fence screwed on; G, hole cut through the fence to admit the head of screw bolt.

Fig. 3, cutter.

In making the plane, let the iron be put about the same as the black line, D, fig. 1, the contrary way, so as to have the face of the iron downwards, and the bevel next the plane; so that when it works, the matches will go over the bevel of the iron, and come out behind.

The one that I have is 18 inches long, 3¾ inches broad, 2¾ inches deep fence; ¾ inch, deep screwed on, with the hole behind, two inches wide, the iron covering the whole of the face; and the two pieces left on each side of the hole, serve to bed the iron upon. The slot hole in the iron to be cut two inches apart in the clear, so that a two-inch shaving will go between the screws; and, to cut a strong shaving, slacken your screws, and knock the iron behind, which will cause it to cut strong. The cutter I have, slits the shaving into fourteen pieces; but any quantity of cutters can be added to the plane; the cutters acting before the iron slit the shaving into the required sizes. Take the cutter out, and you have a shaving according to the breadth of wood cut, of which you can make your boxes. W. Moss.

Birmingham.

THE CHEMIST.

CHEMICAL ANALYSIS.

(*Continued from page* 87.)

Having described the peculiar characteristics of the gases which are most common, or, at least, are more frequently met with in the course of observation than any others, I now propose describing the method of ascertaining the quantity of any peculiar gas when combined with many others. The most usual way of effecting this, is by means of specific gravity. We will take, for example, a mixture of carbonic oxide, subcarburetted hydrogen, and olefiant gas: 100 measures of this mixture being known to contain carbonic oxide, subcarburetted hydrogen, and olefiant gas, we desire to know the proportions of each. The rule is as follows:—The specific gravity of carbonic oxide and carburetted hydrogen or olefiant gas, being the same, viz. 0.972, the first step is, to ascertain their quantity.

Multiply by 100 the difference between the specific gravity of the mixture under consideration, which is 0.638, and the lighter gas or subcarburetted hydrogen, which 0.555. Then divide that number by the sum of the differences of the specific gravity of the mixture, and that of the lighter and denser gas; the per centage of the denser is the quotient. (Vide *Gregory's Mechanics*, Vol. I., page 365.)

For example, we take this mixture, the specific gravity of which is 0.638, and desire to know the proportion per cent. of the two denser gases.

Specific gravity of subcarburetted hydrogen is, 0.555. Then $0.638 - 0.555 = 0.083$ and $100 \times 0.083 = 8.3$.

$$\begin{array}{l} 0.972 \\ 0.638 \\ 0.555 \end{array} \begin{array}{l} \text{difference } 0.334 \\ \text{difference } 0.083 \end{array} \Big\} = 0.417.$$

$$\text{And } \frac{8.3}{0.417} = 20 \text{ (nearly.)}$$

which is equal to the volume of the two heavier gases; therefore there are eighty of the lighter or subcarburetted hydrogen. Now fire the whole with oxygen, and allow 160 of oxygen for saturating the 80 measures of the subcarburetted hydrogen. Then, previously knowing that the saturating power of olefiant gas and carbonic oxide with oxygen, is in the ratio of 3 to 0.5, we will suppose that, in the explosion, 35 cubic inches more of oxygen to have been consumed. Then the quantity of olefiant gas is,

$$= \frac{35 - (20 \times 0.5)}{3 - 0.5} = \frac{25}{2.5} = 10 \text{ measures.}$$

We see, therefore, that this mixture of the specific gravity 0.638, consisted of

0.8	measures	subcarb. hydrog.	= 0.444
0.1	ditto	carbonic oxide	= 0.097
0.1	ditto	olefiant gas	= 0.097
			0.638

MM. Arago and Biot, as well as Sir H. Davy, from experiments upon ammoniacal gas, have determined the specific gravity to be 0.5902; this has been ingeniously employed by some chemists to ascertain the specific gravity of hydrogen, which they have deduced as 0.0694. Their manner of proceeding is as follows:—It being known that two volumes of ammoniacal gas are resolvable into four volumes of constituent gases, viz. 3 hydrogen and 1 nitrogen, you double the specific gravity of the ammonia, viz. 0.5902, and subtract the specific gravity of azote, viz. 0.9722; the remainder divided by 3, will give the specific gravity of the hydrogen in algebraical form thus: — The sum of the

weights being divided by the sum of the volumes, gives the specific gravity of the mixture. Let x be the specific gravity of hydrogen;

Then $\frac{3x + 0.9722}{2} = 0.5902$ the specific gravity of ammonia.

Whence $x = \frac{2 \times 0.5902 - 0.9722}{3} = 0.0694$ specific gravity of hydrogen.

To ascertain the Specific Gravity of a Gas.—Poise a globe which has a stop cock attached to it and open, at the end of a balance; note its weight; then exhaust it by the air-pump and weigh it again; the difference of the two weighings is the apparent weight of the atmospheric air previously contained in it. This should be repeated three times, and the mean of the three trials is to be taken. We now attach, by means of the screw stop-cock, the globe unto an air-jar or gasometer, in which is the gas to be examined, and which must have been previously desiccated by chloride of calcium over lime; now open the communication, and allow the gas to enter, till there is established an equilibrium of pressure with the atmosphere. In transferring the gases, the globe must not be sustained by the hand, but be left dependent upon the connecting screw. Observe, also, that the mercury is on a level, both inside and outside the jar. The globe is now again to be poised upon the balance, and the weight of the included gas ascertained, which, being divided by the weight of the air formerly noted, gives a quotient, which is the specific gravity of the gas required. When great precision is required, the globe should be again exhausted, and the same process repeated a second or even a third time; and it is expedient, after ascertaining the specific gravity of the gas, to reweigh the atmospheric air, lest, during the experiment, its temperature or pressure may have changed.

From experiments by Mr. Faraday, it appears that gases which are not absorbed by water, are kept more perfectly from being contaminated by the atmospheric air, by leaving the jars containing them inverted in *water*, than if they were so over *mercury;* as, in that case, the filtration is not through the pores of the mercury, but along the surface of the glass; but before they are weighed, the air and water should be brought to the same degree of temperature.

To reduce the volume of a gas at any certain pressure to what it would be under the mean pressure of thirty inches of mercury, multiply by the particular barometrical pressure the volume of the gas, divide that product by thirty, and the quotient is the true volume.

MISCELLANEA.

Protoxide of Lead found in the Animal Tissues.—M. Tauquerel Desplanches has shown, that the skins of animals submitted to hydro-sulphuretted baths, acquire a black tint, indicating the presence of a compound of lead in the tissues. From hospital statistics it is ascertained, that forty-seven men working in lead compounds, died during the years 1833-34-35-36-37. M. Laissainge considers that it would be of the greatest importance to discover the presence of oxide of lead in the tissues of subjects working in lead manufactories. Some experiments have been made, but without success.—*Journ. de Chemie Medicale.*

Heat produced by Slacking Lime.—In the 23rd tome of the *Annales de Chemie et de Physique*, I observed there were some experiments instituted for the purpose of ascertaining whether the heat given out during the slacking of lime, was sufficient to fire gunpowder. "A small quantity of it was put into a glass tube hermetically sealed at one end, and was then placed in slacking lime. Some minutes elapsed without any effect being perceived, except the volatization of some of the sulphur contained in the powder; but at length a loud explosion took place, however, without breaking the tube." I have made since a few experiments respecting the length of time and temperature required to explode some other chemical combinations, the results of which are as follow:—

	Fahr.	Minutes.
Hall's gunpowder	510°	7
Iodide of nitrogen........	112	1.5
Fulminating mercury	119	2.25
Common fulminating powder	525	8.15
Fulminating gold	105	2.75

Each was immersed a depth of one foot in the lime; and the thermometer had between it and the tube containing the mixture, a partition of the lime about one inch thick. As soon as the explosion had taken place, the lime was immediately removed from around the thermometer, that the temperature might be observed. The tube was broke by the iodide of nitrogen, and the common fulminating powder only. Query, might not unslacked lime be used for the firing of gunpowder in submarine operations?

MANIPULATOR.

To Turn the Hair Black.—Mix pomatum with pearl white (precipitated bismuth); this will turn the hair black.

A Depilatory.—Quicklime, one ounce; orpiment, three drachms; orrice, two drachms; nitre, one drachm; sulphur, one drachm; soaplees, half-a-pint. Evaporate to a proper consistence.

Another.—Lime, twelve ounces; starch, ten ounces; orpiment, one ounce. Mix.

Extemporaneous Aromatic Vinegar.—Acetate

of potassa, one drachm; essence of lemon, three drops; sulphuric acid, twenty drops.

Cold Cream.—Oil of almonds, one pound; white wax, four ounces; melt and pour into a warm basin, then add by degrees rose-water, one pound.

Powerful Antiseptic.—Nitrate of silver is the most powerful antiseptic known. One ounce dissolved in 12,000 ounces of water, will preserve the water from putrefaction for ever; and it may easily be separated therefrom, by adding common salt, which will precipitate the silver in the form of a chloride.

Indelible Purple Ink.—Dissolve in distilled water some crystals of the nitro-muriate of gold. Write therewith, and expose the writing to the sun, it will instantly change to an indelible purple.

Bug Poison. — Corrosive sublimate, two drachms; spirits of wine, eight ounces; rub together, and add oil of turpentine, eight ounces.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, Aug. 5, E. W. Brayley, Jun, Esq., on Igneous Geology. Friday, Aug. 7, J. Smith, Esq., on Provident Institutions. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street. — Thursday, Aug. 6, J. H. Pepper, Esq., on Phosphorus and its Compounds. At half-past eight.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, Aug. 5, Mr. Thomas Wiglesworth, on the Properties of Bones. At eight o'clock.

QUERIES.

By what means could I take off the alkaline smell of soap preparatory to scenting it? It seems as if alkalies had the power of absorbing scent; for it requires an immense quantity to be put in, before any smell of pleasant odour can be perceived. G. H. W.

1. What is the arrangement in the battery called "Smee's battery?" 2. What compositions will produce purple fires? 3. What is the liquid used in producing the fire cloud? 4. By what means may zinc be reduced to a fine powder? F.

ANSWERS TO QUERIES.

To Clean Paper Walls.—Rub them with the crusts of a stale loaf, having some of the crumb on them.

Tutenague, white copper, or pak fong, is a compound metal brought from China, and contains 15 nickel, 28 zinc, and 21 copper. Is malleable.

To make Rice Glue.—Mix rice flour intimately with cold water, then gently boil it. It is beautifully white, dries almost transparent, and is in every respect superior to paste made of wheaten flour.

To make German Paste for Birds.—Take pea meal, two pounds; blanched sweet almonds, one pound; fresh butter, three ounces; beat together, then add a little honey and cake saffron shred. Pass through a colander to granulate it. Some, put in the yolks of two eggs; but this makes it too expensive and too fattening for the birds. It will keep good six months.

TO CORRESPONDENTS.

Arnold Boulter.—*Both air and fire balloons (especially the former) must be made extremely light, when of small dimensions. For a smal lfire balloon, from two to three feet in height, take thin tissue paper, joined by paste in light and narrow seams; fill a small piece of sponge with oil of turpentine, and attach it at the orifice of the balloon by means of very thin wire. When it is lighted, if care be taken to prevent the flame from coming in contact with the paper, the balloon will infallibly ascend. For a small air balloon, hydrogen should be employed in preference to the coal gas, the latter being heavier, and, consequently, lessening the ascending power. Hydrogen gas may easily be procured, by putting sulphuric acid (oil of vitriol) in a bottle with iron filings or pieces of zinc, and adding water till a great effervescence takes place. The gas may be collected in a bladder tied to the neck of the bottle.*

J. M. K.—*We will endeavour to obtain the best information on the subjects of his queries.*

J. Hilton *should write to some of the publications which treat on medicine.*

A Subscriber *and others, who have addressed to us questions concerning manganese, in our next.*

L. H. W.—*The best advice we can give is, that he should forthwith publish his invention without reserve. The Society of Arts can afford him but slender aid, even if he has friends enough to procure him their patronage; and, as for the Royal Society, he might as well consign his model to the bottom of a well, or lay it on the table of the House of Commons; for if he sends it there, it will never see day-light again, unless our correspondent is prepared to spend five or six years in attending upon the council, and eating muffins with the president; then, indeed, at the small charge of a few dozen brace of pheasants sent at the proper season, and to the proper quarters, his communication may possibly be read; but the Royal Society of London have declared and publicly proclaimed their determination,* never to express an opinion upon anything; *and when the thanks of this extraordinary body is occasionally awarded for some remarkable communication, it is to be considered only as an act of politeness and courtesy towards the person who introduces it, without any reference to nature or merit of the communication itself!*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by D. A. DOUDNEY (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

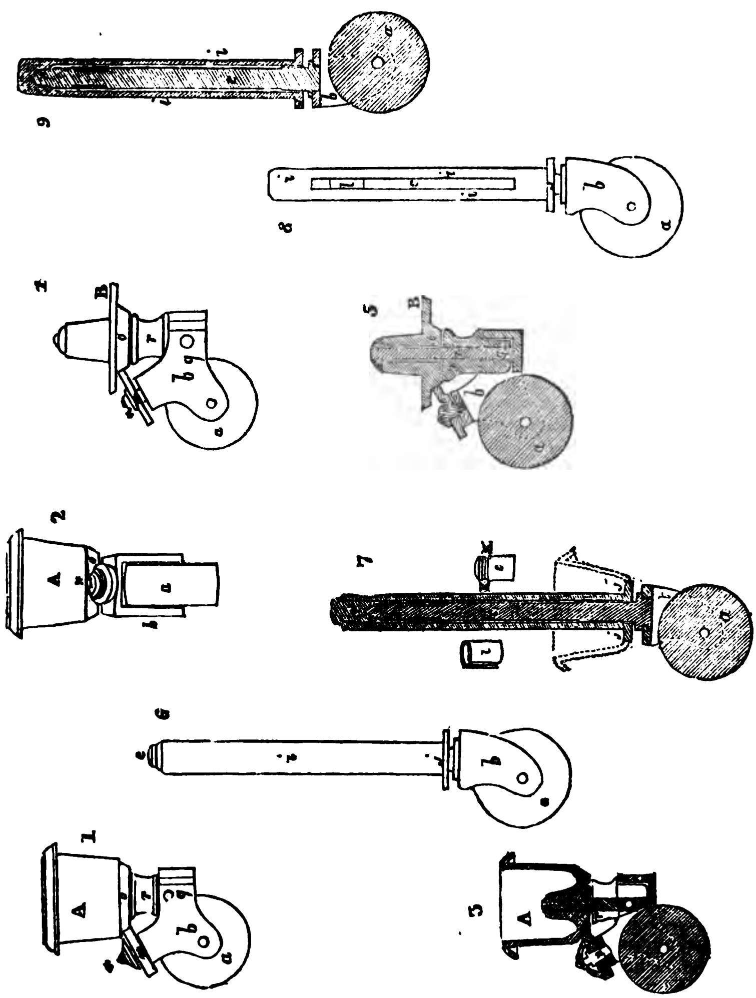
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 104, NEW SERIES. | SATURDAY, AUG. 8, 1840. PRICE ONE PENNY. | No. 225, OLD SERIES.

HARCOURT'S PATENT CASTORS.



City Press, 1, Long Lane: Doudney and Scrymgour.

HARCOURT'S PATENT CASTORS.

(*Abstract of Specification.*)

Description of the Drawing.

Fig. 1 represents a side view of a socket-castor, constructed according to the first part of my invention.

Fig. 2 is a front view thereof; and

Fig. 3 is a section of fig. 1.

And in order to show that plate-castors may be made according to this part of my invention,

Fig. 4 is a side view; and

Fig. 5 a section of a plate-castor, similar in construction to fig. 1, excepting in respect to the means of applying castors to furniture; the one being a socket-castor, the other being a plate-castor, and the parts are marked with the same letters of reference. *a* is the wheel or roller, moving on an axis, carried by the frame, or what is commonly called the horn, *b*, the nature of which is clearly shown in the drawing; A is the socket of the castor, fig. 1, and B is the plate of the castor, fig. 4, by which the castors are respectively affixed. The horn or frame, *b*, is capable of movement on an axis, *q*, which axis passes through the pin, *p*, which is carried by the socket in the plate, B, as is shown in the drawing, but is capable of turning freely; *r* is an external ornamental covering and support of the lower part of the pin, *p*; and such covering constitutes the standard between the horn or frame, *b*, and the plate, B, or the socket, A, as are respectively shown in the various figures of the drawing under description. The frame, *b*, carries a friction-wheel, *m*, which moves on an axis, *n*; this friction-wheel moves against the circular inclined track, O, consequently it will be seen, that the pressure on the pin, *p*, will have a tendency to force the horn or frame downwards towards the ground, at the point where the horn, *b*, is connected to the pin, *p*; but such pressure will keep the wheel, *m*, in contact with the track, O, and thus relieve the pressure on the pin, *p*.

I will now proceed to describe the second part of my invention; in doing so I would remark, that the same has for its object various constructions of bearings of the main-pin or axis on which the castor turns; and by means of such improvements I am enabled to construct castors with much greater length of main-pin or axis, by which the weights carried by such castors are more advantageously borne or carried, and the castors are rendered less liable to the prejudicial action of strains.

Fig. 6 is a side view; and

Fig. 7 is a section of a castor, constructed according to this part of my invention; *a* is the ordinary wheel or roller, moving on an axis, carried by the frame or horn, *b*, and this horn has the main-pin or axis, *c*, affixed thereto; and it will be seen that this pin or axis, *c*, is much longer than those heretofore used, by which the main point of bearing is carried up a considerable height within the leg of the piece of furniture to which such castor is applied, which will be found very advantageous in the construction of castors; and it is this circumstance of great increase of length of the main-pin or axis on which the castor turns, when combined with either of the constructions of apparatus and bearings, and means of applying the same, that constitutes the second part of my invention. *i* is a tube, within which the axis or pin, *c*, moves freely, it being so made as only to touch at the lower part of the tube; the conical part at the upper end, entering a conical hole in the piece of metal introduced or applied and affixed into the upper end of the tube, *i*, or the end of the tube may be welded together to form the end bearing, *e*. I would remark, that I prefer that the piece of metal, *e*, should be of iron, case-hardened; but other materials may be used. The tube, *i*, according to one mode of construction, is made of plate-metal, having a flange or circular plate, *j*, affixed, by brazing or otherwise, to the lower end; and this plate may be used in like manner to plate-castors; or in place thereof, a socket may be applied of brass or other suitable material, as is shown by dotted lines in fig. 7. At the same time I would remark, that in using such long axes and tubes for bearing, the simple act of making the holes in the furniture of such a size as to require the tubes to be slightly driven, will be holding enough without screws. The piece of iron, *e*, is affixed by means of a groove, *k*, formed therein, into which the end of the tube is turned or hammered; or it may be fixed by brazing or by other convenient means. By this mode of constructing a tube, *i*, combined with the upper bearing, *e*, it will be evident that the main-pin, *c*, may be of any desired length, by which the main point of pressure on to the castor will be at a considerable height above the roller; and it will be evident, that where the castors are larger than that shown in the drawing, the main-pin or axis, *c*, may with advantage be made longer; but for the size given in the drawing, I consider the length of tube which carries the bearing, *e*, to be a convenient and proper length, but I do not confine myself thereto. In the

pin, *c*, is formed a groove which receives a hoop-spring, *b*, the object of which is to retain the axis in its place, and at the same time will allow of its easy turning in the tube, as will readily be understood on examining the drawing. The tube, *i*, may be made of any suitable sheet metal strong enough for the purpose, and which can readily be made into a tube. I prefer wrought iron for the purpose. Another mode of making the tube is of cast iron or malleable cast iron or cast brass, by casting it in a suitable mould, as is well understood in casting tubes in such metal; but when the tube, *i*, is cast, I apply the piece of metal, *e*, by brazing or by pinning, as the cast iron will not allow of hammering the upper end thereof into a groove, as plate metals will. In using malleable cast-iron when the same is annealed, as is well understood, it may either be hammered into a groove, as above described, or it may be affixed to the bearing piece, *c*, by brazing or other convenient means. It should, however, be understood, that this part of the invention does not relate to any new mode of making tubes, but only relates to the making of suitable tubes to carry the bearings, *e*, which are to be applied to such tubes at a considerable distance from the castors with which they are combined. Another part of my invention relates to combining certain cast-iron or cast malleable-iron frames for carrying a suitable bearing, *e*; but in the present instance the bearings, *e*, are not applied to the tubes after they are formed, as is the case when using the cast tubes above mentioned; but such bearings are cast of the same metal as the frames which carry them, and this part of the invention may be said to consist in the application of bearings, *e*, cast frames, in order that such bearings, *e*, may be at a considerable distance above the castors or rollers thereof; and such frames could not be made in like manner to the short tubes now in use, which are cast vertically on metal cores. The mode of constructing the frame, *i*, consists in making a tube, *i*, in iron or brass, or other suitable material to be used as the model of the frame, to be cast therefrom; and as it is difficult to have the end, *c*, cast thereon, which is to constitute the bearing, *e*, when the inner core is supported only at one end. I remove a portion of one or two sides of the model for two or three inches in the length, in such manner as to produce long openings into the tube; by this means, when the interior of the tube is filled with a cylindrical pin, the arcs of the circle of such cylindrical pin will protrude; hence when the model tube with its flange is pressed into the sand to form a mould, the sand will fill up the portions of the model where it is cut away, and the inner core or pin will make a slight recess in the sand, the object of which is, to receive and support the proper sand core; and by such recess the sand core will be supported for a considerable part of its length, and thus may any desired and suitable length of tube be cast with an end, *e*, thereto, as is shown at fig. 8; and it will only be desirable farther to remark, that in order to complete such tubes when cast (and if they be of malleable cast-iron, they are to be annealed, as is well understood in working with such metal), they are put into a lathe, and the lower side of the flanch faced, and, by a suitable drill, the bearing, *e*, is to be formed. Another part of my invention relates to the application of a complete cast tube, *i*, of the required length, so as to dispense with holes for screws; and in making such tube, *i*, the sand core is of such a length, that it may be embedded at its outer end in sand to such an extent, as not to require support beyond the flanched end of the tube, *i*; by this means a complete tube may be cast, as shown at fig. 9, with the end, *e*, thereon, and the flanch having no holes for screws, the length of tube enabling it to be fixed without screws; the tube is then to be finished as last above explained. It should be stated that, in making sand cores for the interior of the tubes, I place a wire in each core to give and branch thereto, as is well understood by moulders. I would remark, that there is an advantage in using malleable iron for the frames, and for the tubes, *i*, as the ends, *e*, can be tempered or hardened, and thus be more lasting.

VAUX'S PATENT REVOLVING HARROW.

(Concluded from p. 107.)

As to the dimensions of the larger sort, every farmer may exercise his own discretion: from four to five feet wide will probably prove the best. In using these harrows on stiff soils, or on light soils full of couch-grass, it may be necessary to take out every other tine from the nave of the front set—being fastened by bolts and screws, this will be easily accomplished without the aid of a smith; or one set of tines with the nave may be taken off the axle, and the rest adjusted.

There is a provision for throwing nearly the whole weight of the outer frame upon

the tines, by placing the bolt attached to the upright part of the frame, on the opposite side of the spoke of the wheel to that on which it is placed for the purpose of keeping them out of action, when they do not penetrate through the furrow-slice, which may be the case on very stiff or foul soils when not quite dry.

As to the management, nothing more is required than to raise the tines out of action, and to let them down at every turning, which is done by turning the hand-wheel once round and placing a bolt, provided for the purpose, behind a spoke of the wheel.

It is necessary to observe, that the tines should always be raised out of action before the front wheels begin to turn on the headland, otherwise they will be bent. The superiority of the revolving harrow over those now in use, may easily be comprehended, both as to the power necessary to accomplish the object required, and the effect produced, by supposing a man to place a three-pronged dung-fork at one side of a piece of ploughed ground, and try the difference of the force required to push it through in the same manner that the tines of a drag are forced through; then let him with the same tool, fork the ground over in the ordinary way, and it will be perceived, that forcing the fork through may be compared to the manner in which the old drag performs its operations, and that of forking over the ground to the work of the revolving harrow. This is so obvious, that on ground which requires four ploughings (the average number independent of the seed furrow), dragging, and numerous harrowings with the old implements, to make a fallow, may be as effectually prepared by two ploughings, and less than half the draggings and harrowings* with this harrow; consequently will be a saving, in a very short time, of a sum far exceeding the cost of this implement.

The materials of which these harrows are constructed, consist of the best wrought and cast iron, the former being as three to one of the latter; part of the frame-work may, however, be constructed of wood, which will greatly reduce the cost.

The weight will vary from about 5 to 15 cwt.

* I say draggings and harrowings, because the revolving harrow answers all the purposes, at one operation, of a spiked roller, the heaviest drag, and the lightest harrow of the common sort; it will, therefore, be found a valuable acquisition on those occasions in which it is desired to break the furrow-slice of ley, clover, and other stubbles.

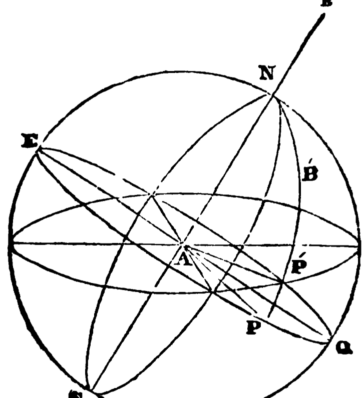
Country smiths will, on application to Mr. Daniel Green, No. 36, King William Street, London Bridge, agent to the patentee, be supplied with castings, and licence to manufacture.

The revolving harrow may also be had of Messrs. Gibbs, seedsmen, Half-moon Street, Piccadilly.

ON THE CONSTRUCTION OF SUNDIALS.

The whole theory of dialling depends on this one principle—that the sun revolves about a sphere fixed to any part of the earth, in the same manner that it does about the earth itself.* Thus, if we construct a globe, and mark upon it meridians, an equator, &c., and place it so that its axis may be parallel with the axis of the earth, the same phenomena of light and darkness will be observed upon this globe as upon the earth itself.

Thus let N E A Q S, fig. 1, be a sphere, having its axis,



N S, parallel to the axis of the earth, then E Q, the plane of its equator, will also be parallel to the plane of the terrestrial equator; and let H O be a horizontal plane, drawn through the centre, A. Then let its axis be produced; that is, a pin driven in at its north pole, N, in the same right line as the axis of the sphere. Then if the sun be supposed to revolve round this globe, it will cast a shadow of the pin, A B, upon the surface of the globe, as shown at N B in the figure.

* In this statement, we do not mean the *real* but the *apparent* motion of the sun.

Then as there are 360 degrees in the whole circumference of the great circle, E A Q, and as the sun takes twenty-four hours to revolve round the earth, there must necessarily be fifteen degrees described for each hour that the sun continues its revolution. Then if the circle, N H S Q, be supposed to be the meridian of the place, and as the sun is always on the meridian at noon or twelve o'clock, it is evident that the angle, Q N P, measures the time from noon of the shadow of the pin falling at N P.

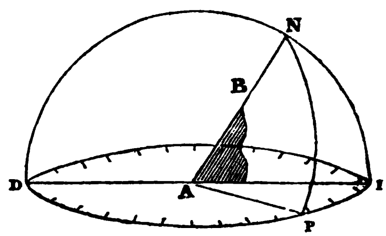
Now if the whole sphere be supposed to become transparent, and an opaque plane be supposed to be drawn through its centre parallel to the terrestrial equator, the shadow of the pin, A B, will be shown in that plane in the direction A P, the angle, Q N P, or arc, P Q, denoting the time from noon. Thus the simplest form of dial is one whose plane is parallel to the terrestrial equator, and, therefore, the *hour angles* (that is, the angles described in each hour) must be each equal to 15°.*

Then if we wish to construct a dial having a face in any other direction, we have only to draw a plane in that direction through the centre, A, and to see where the line, N P, cuts this plane (as at P′ in the plane, H A O), and the distance from that point to the meridian, reckoned in that plane, will denote the same hour as the distance, P Q, in the former plane.

We now proceed to investigate the cases where the planes are horizontal, and those where they are due north, south, east, and west.

Let D I (fig. 2) represent the *horizontal* plane, upon which we wish to construct the dial. Let I be the point from which the hours are to be measured, that is, the point on which the shadow falls at noon. Let A B represent the stile or pin of the dial; then as D I is horizontal, and N A parallel to the axis of the earth, we have I N equal latitude of the place for which the dial is to be constructed; that is, $\angle$ N A I = latitude of place. Let this be denoted by λ; also the angle, I N P, measures the space passed over by the sun in

FIG. 2.



a given time; let this be denoted by h; whence, in the spherical triangle, N P I, we have,

$$\angle \text{ N I P} = 90^\circ$$
$$\angle \text{ L N P} = h$$
$$\& \text{ I N} = \lambda.$$

Whence, by Napier's formula,

$$\text{Sin. N I} = \text{tan. P I cot. P N I};$$
$$\text{Or, sin. } \lambda = \text{tan. P I cot. } h;$$
$$\therefore \text{tan. P I} = \text{sin. } \lambda \text{ tan. } h.$$

Or, by putting h successively, equal to 15°, 30°, &c., we get the different angles N which the hour lines must make with the line, A I, at a given latitude (λ).

Let this latitude be that of Greenwich $= 51^\circ\ 29'$ N; then if we put P I = H, we have

(1.) $\text{Tan. H} = \text{sin. } 51^\circ\ 29' \,.\, \text{tan. } 15^\circ = \text{tan. } 11^\circ\ 50'$

(2.) $\text{Tan. H} = \text{sin. } 51^\circ\ 29' \,.\, \text{tan. } 30^\circ = \text{tan. } 24^\circ\ 18'$

(3.) $\text{Tan. H} = \text{sin. } 51^\circ\ 29' \,.\, \text{tan. } 45^\circ = \text{tan. } 38^\circ\ 2'$

(4.) $\text{Tan. H} = \text{sin. } 51^\circ\ 29' \,.\, \text{tan. } 60^\circ = \text{tan. } 53^\circ\ 35'$

(5.) $\text{Tan. H} = \text{sin. } 51^\circ\ 29' \,.\, \text{tan. } 75^\circ = \text{tan. } 71^\circ\ 6'$

(6.) $\text{Tan. H} = \text{sin. } 51^\circ\ 29' \,.\, \text{tan. } 90^\circ = \text{tan. } 90^\circ$

(7.) $\text{Tan. H} = \text{sin. } 51^\circ\ 29' \,.\, \text{tan. } 105^\circ = \text{tan. } 108^\circ\ 54'$

(8.) $\text{Tan. H} = \text{sin. } 51^\circ\ 29' \,.\, \text{tan. } 120^\circ = \text{tan. } 126^\circ\ 25'$

(9.) $\text{Tan. H} = \text{sin. } 51^\circ\ 29' \,.\, \text{tan. } 135^\circ = \text{tan. } 141^\circ\ 58'$

(10.) $\text{Tan. H} = \text{sin. } 51^\circ\ 29' \,.\, \text{tan. } 150^\circ = \text{tan. } 156^\circ\ 42'$

(11.) $\text{Tan. H} = \text{sin. } 51^\circ\ 29' \,.\, \text{tan. } 165^\circ = \text{tan. } 168^\circ\ 10'$

(12.) $\text{Tan. H} = \text{sin. } 51^\circ\ 29' \,.\, \text{tan. } 180^\circ = \text{tan. } 180^\circ$

Whence, for

* The practical objection to this construction is, that it shows the time only six months in the year, that is, during the summer months, when the sun is north of the equator. When the sun is south of the equator, the under side of such plane would be illuminated, consequently the shadow of the stile could not be projected on the upper surface; also at the equinoxes, the sun's rays being parallel with the plane of the dial, the edge only will be illuminated, and the shadow will fall on neither side, supposing a stile to be fixed to the under as well as the upper surface.—ED.

P.M.	A.M.		°	′
Noon or 12		the angle, I A P, must be	0	0
1	— 11	....	11	50
2	— 10	....	24	18
3	— 9	....	38	2
4	— 8	....	58	35
5	— 7	....	71	6
6	— 6	....	90	0
7	— 5	....	108	54
8	— 4	....	126	25
9	— 3	....	141	58
10	— 2	....	155	42
11	— 1	....	168	10
12	— midnight	....	180	0

(*To be continued.*)

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(*Continued from page* 103.)

THE chapel of Our Lady, usually called Beauchamp Chapel, adjoining the south chancel of St. Mary's Church, is a beautiful specimen of the florid Gothic style of architecture, and well deserves the attention of the traveller. The church of St. Nicholas is a modern Gothic building.

GUY'S CLIFF is about a mile and a half from Warwick; it is a most romantic and attractive spot, said to have been the retreat of the champion Guy, after his battle with Colebrand the Dane.

KENILWORTH is a small market town of Saxon origin, 95 miles from London, and about five miles from Warwick and Coventry. The castle, though now a ruin, exhibits relics of former strength and grandeur; and the many historical events connected with it are impressed upon the mind by the great reviver of history, Sir Walter Scott, whose genius illuminated every subject and every event which his prolific pen has recorded.

STRATFORD-UPON-AVON was a place of some importance 300 years before the Conquest. It contains, besides other remarkable edifices, a church, elegantly decorated, and approached by an avenue of lime-trees, whose overhanging branches chase the wanton sun-beams from the solemn place, and twine together like the arms of angels, watching over some adored and kindred spirit; the pensive pilgrim moves slowly on in silent awe and reverence, more deep, and more sincere, than ever Moslem felt at Mecca's shrine—

"And thereby hangs a tale."

Seven cities contended for the honour of giving birth to the prince of Greek poets: Mantua, Sulmo, and Venusium, glory in their Latin bards; and every age has been adorned by the bright lustre of genius—some fleeting as the meteor that dazz'es for a moment, and then vanishes in the mists of night; others, mighty as the celestial fire that cleaves the massive rock, and leaves to after ages traces that no human hand can efface; but "the Bard of Avon" stands alone and unrivalled in his glory; he was not the poet of an age or of a nation, but an incarnation of the genius of poetry—the world was his school, and nature his book. To him, the secret workings of the human mind were as familiar as the deepest mysteries of science; and the melody of his numbers is not more admirable than the profundity of his discourse. Men may marvel to see so much wisdom spring from an unknown source, without the aid of human teachers; but his mission was to teach, not to be taught—to enlighten the world, not to borrow from the dim tapers that preceded him; and this is a mystery known only to the genius that possessed him.

Scit genius, natale comes qui temperat astrum,
Naturæ deus humanæ, mortalis in unum—
Quodqe caput: vultu mutabilis, albus, et ater.
HOR. Ep. 2.

Genius, poet, angel, or whatsoever he was, we shall never look upon his like again.

Shakspeare was born at Stratford in 1564; and, after accomplishing his high mission, departed from this world in 1616, leaving his mortal remains deposited in this church, where they still remain undisturbed.

Sweet bard! look down with mercy on the presumptuous hand that dares to scan thy greatness!

From the Coventry station, the railway passes through a cutting, and afterwards upon an embankment, from which a good view of the country is obtained, and another cutting to Beechwood Bridge, a beautiful structure, seventy-six feet span, and rising only seven feet six inches in the centre. A short distance beyond this, is Beechwell Tunnel, 160 yards in length, with an entrance in the Egyptian style of architecture. Four miles farther is the

HAMPTON STATION, an intermediate one, 102¼ from London, and 9¾ from Birmingham.

The Birmingham and Derby Junction Railway branches off from this place. Here the line commences a gradual ascent, which continues about seven miles, passing under the London and Birmingham road, and then on an embankment over

the Marston Green, Easthall, and Sheldon viaducts, crosses a branch of the river Cole, and enters Worcestershire, passing through an excavation, in some places forty-five feet deep. After this, commences another embankment, which crosses the river Cole by a bridge of six arches, and re-enters the county of Warwick.

FIRE-ESCAPE.

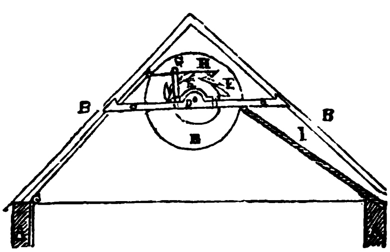
To the Editor of the Mechanic and Chemist.

Sir,—Observing in your valuable miscellany, page 220, an account of a fire-escape, I am induced to send you a sketch of an apparatus for the same purpose, which I invented some years ago, but of which I made no use at the time, farther than showing to some friends; should you think it likely to answer the desired end, viz. as an appendage to detached houses, banks, &c., for the rescue of lives and valuable property in cases of fire, I shall be happy to see it get a place in your useful pages.

I remain yours, &c.
E. Roxbey,
Glasgow. Basket-maker.

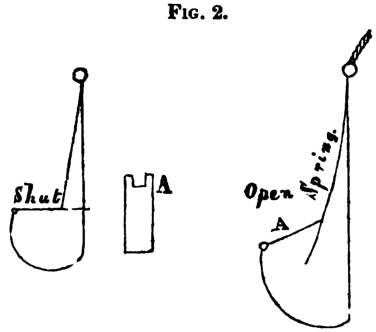
Fig. 1, A A represents a section of the outside walls of a house; B B, the rafters, with C, a tie-beam. On two adjoining tie-

Fig. 1.



beams are fixed blocks, D, forthe axles of a roller, E, to turn in. On each end of this roller are fixed deep ends, E′, and on one end outside of this deep end, is fixed a ratchet-wheel, F. Into the tie-beam, C, is screwed an upright, G, on a pin in which the lever, H, works freely. On one end of this lever is a tooth, which takes into those of the ratchet-wheel, and on the other an eye, to which is affixed a wire, which may be led by pulleys and cranks to any or many parts of the house, in the manner of ordinary bell-wires. I, an inclined plane of any hard smooth wood, terminating in an opening in the outside wall under the eaves of the roof. To the roller, E, is attached the end of a rope or chain ladder, of considerably greater length than the height of the house, which ladder is wound on the roller, and confined in its place by the deep ends F′. To the other end of the ladder is attached a weight of such magnitude as to overcome the friction of the roller with the ladder on it. The operation will now be evident; any of the wires attached to the lever being pulled, the tooth on the other end will be disengaged from the ratchet-wheel, the roller being now free to move, will immediately be carried round by the descent of the weight at the end of the ladder; and thus the ladder will be carried to the ground, where it may be held or otherwise fixed by the spectators. The great length of the ladder is useful, to enable it to be carried to any part of the house, according to where the fire may be, which may be done as follows:—A long line of whipcord being attached to the ladder with a bullet or other weight at its other end, and it being wished to attach the ladder to any particular window, a spectator throws the bullet to the person inside, who, by the cord attached, is enabled to draw the ladder to him, and to attach it to the sill of the window by means of the hooks shown in fig. 2. These consist of

Fig. 2.



two spring hooks, such as are used at our collieries, all rivetted together by an iron bar of the same length as one step of the ladder; these lock on one step of the ladder by means of their springs. To an eye on the shank of each of these hooks is fixed a short rope, whose other ends are attached to eyes in the shank ends of two strong common hooks, which hook on to the window-sill; and by this means the position of the ladder may be varied at pleasure. From the small space occupied by this fire-escape, it may be rendered fire-proof at very little expense, and thus be made to last so long as the external walls remain sound.

DR. TURNBULL.

We are happy to be able to state, from our personal observation a few days ago, that Dr. Turnbull, of Russell Square, has just made a new and important invention, in addition to his other discoveries for the cure of persons labouring under diseases of the ear. It is a syringe or ear-pump, about six inches in length, and four inches in diameter. The handle is hollow, with a screw fitted to its top for the purpose of introducing a small piece of sponge, upon which the ethereal or medicated liquid is dropped. The bottom or lower part consists of a small opening, and the point is like a syringe, made of India-rubber, but exactly fitting the outward orifice of the ear. When the handle of the ear-syringe is drawn out, the ethereal body escapes, fills the cavity of the ear, and at the same time takes off the atmospheric pressure, thereby allowing the seruminous glands to secrete abundance of wax, and securing the healthful exercise of the organs. The rapidity with which the wax is formed is really surprising, as it often begins to fill the ear in five minutes. By means of this most important and ingenious instrument, Dr. Turnbull is enabled to effect cures in cases of deafness, which formerly baffled the skill of the most experienced aurists.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, Aug. 12, E. W. Brayley, Jun, Esq., on Igneous Geology. Friday, Aug. 14, H. Brown, Esq., on the Preparation and Adaptation of Corneous Substances to the various purposes of Commerce. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, Aug. 13, S. C. Horry, Esq., on Juries. At half-past eight.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, Aug. 12th, Lecture and Discussion—Is Teetotalism beneficial to Society? Mr. T. James. At eight o'clock.

QUERIES.

How to make electrotype seals? M. H.

How the reddish composition is made, with which shell-work is fastened, for chimney ornaments? I would beg leave also to hint to your kind correspondents, that I think it would be better if they would give the names of their drugs, &c., in the language of commerce, as well as in the chemical nomenclature; as they may be obtained considerably cheaper by the former than the latter name. W. T.

How are the backs of books made flexible, without being made hollow? C. J. L.

The method of giving that metallic bloom-like appearance on the colour-saucers, whether the finishing process is by baking or not? W. R.

The method of French polishing the carved parts of furniture? I have succeeded in putting it on plain work, as given in the directions in No. 118, Vol. III; but that direction does not answer for ornamental work. AN AMATEUR.

The best method for rendering whalebone white? A SUBSCRIBER.

By what process plaster-of-Paris moulds can be rendered fit to take metal casts from; as I have tried it in various metals, such as lead, pewter, and invisible metal, but cannot make it answer at all? I. E. I.

Can any of your readers inform me where I can borrow Logier's work on "The Theory and Practice of Music?" The price of the work being 2*l*., I cannot afford to purchase it. What is the construction of Fuller's freezing machine? Have any of your readers a second-hand oxy-hydrogen microscope for sale?

QUERIST.

ANSWERS TO QUERIES.

To make Compo-Ornaments for Picture-frames, &c.—Boil seven pounds of the best glue in seven half-pints of water; melt three pounds of white resin in three pints of raw linseed oil. When the ingredients are well boiled, put them into a large vessel and simmer them for half-an-hour; stirring it, and taking care it does not boil over. When this is done, pour the mixture into a large quantity of whiting (previously rolled and sifted very fine), and mix it to the consistence of dough, and it is ready for use.

Birmingham. G. D. LABOSZIER.

Fly Poison.—Dissolve, by boiling, one drachm of white arsenic in a pint of water. Sweeten with treacle.

TO CORRESPONDENTS.

R. Brownlow.—*We will endeavour to obtain the address he requires, next week.*

A Constant Reader.—*Nitrate of silver; but it will stain almost everything it touches.*

An Amateur. — *The lithographic stones are mounted on wood blocks, and then printed in the same manner as type metal. The price of the plates is regulated by the dimensions. The cost of the stereotype plates for a tract, with four pages, similar to those of the Religious Tract Society, would be about 6s. or 7s.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by DOUDNEY & SCRYMGOUR (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

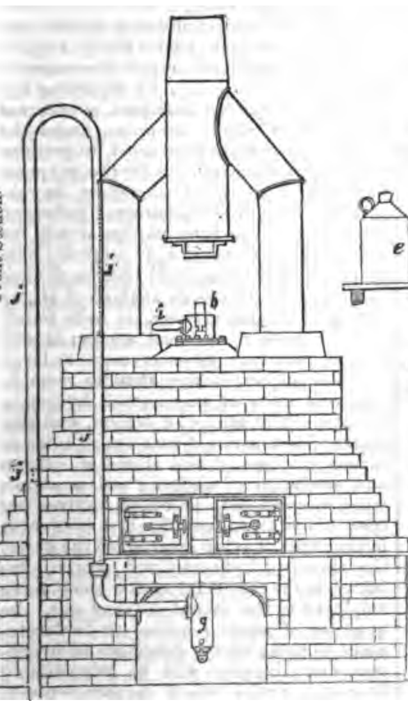
MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 105, NEW SERIES. | SATURDAY, AUG. 15, 1840. PRICE ONE PENNY. | No. 226, OLD SERIES.

VAL MARINO'S PATENT GAS-APPARATUS.

Front Section.



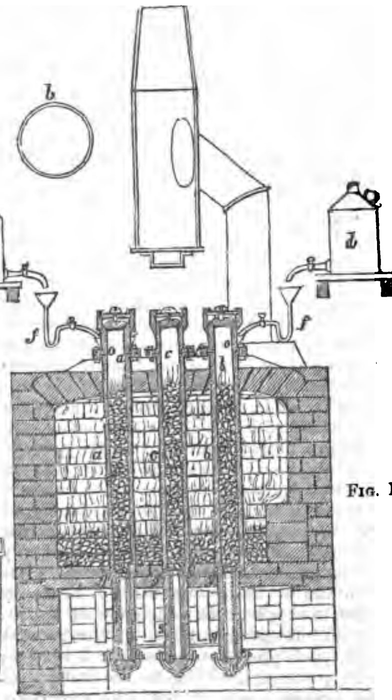
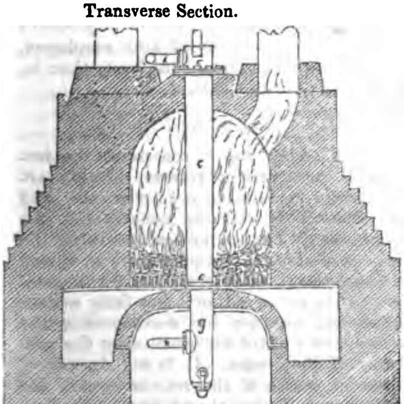


FIG. 1.

Transverse Section.



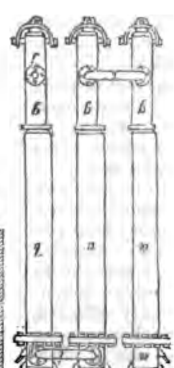


FIG. 3.

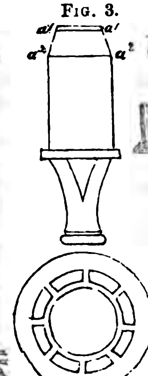
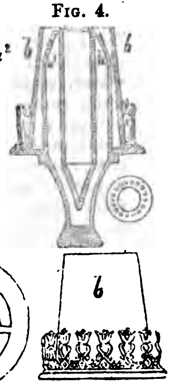


FIG. 4.



City Press, 1, Long Lane: Doudney and Scrymgour.

VAL MARINO'S PATENT FOR IMPROVEMENTS IN THE MANUFACTURE OF GAS,

And in the Apparatus employed in Consuming Gas.

(*Abstract of Specification.*)

My invention relates, first, to a mode of manufacturing gas for the purpose of light, from coal and other tar and oils, and other fatty matters, together with water; and,

Secondly, my invention relates to an improved arrangement or construction of apparatus or burner for consuming gas for the purposes of light. And, in order to give the best information in my power, I will describe the apparatus used, and the process pursued by me in carrying out my invention. And I would first remark, that it is well known that in converting tar, oils, and other fatty matters into gas for the purposes of light, owing to the excess of carbon it contains, and the consequent want of hydrogen and oxygen in converting such matters into gas for the purpose of light, much of the carbon contained therein cannot be beneficially employed, but is, in fact, lost in the process of decomposition, owing to the want of a sufficient dose of hydrogen and oxygen, in order to convert the whole of the carbon into carburetted hydrogen. And in order to make up for such deficiency of hydrogen and oxygen, requisite for fully saturating the carbon contained in the tar, or in any particular oil or fatty matter, recourse has been had to the decomposition of water, in order to supply such deficiency of hydrogen and oxygen; but, up to the present time, such processes have not, I believe, been successful, owing to the nature of the process pursued, and the apparatus employed.

Now the first part of my invention has for its object a mode of decomposing tar, oils, and other fatty matters, and also water, whereby I am enabled to obtain a more complete combination of the gases evolved; and, consequently, a more beneficial result than heretofore has been accomplished. And such is the nature of the apparatus and process, that the tar, oil, or fatty matter employed, is fully decomposed, by being exposed to highly-heated surfaces of coke or charcoal; and the water is also fully decomposed in suitable vessels or vessel, and acted on by highly-heated coke or charcoal or surfaces. The gas products of the water are, when fully effected, brought into a highly-heated retort, or such like vessel, filled with coke or charcoal, wherein the decomposing of the tar, oils, or fatty matters, is going on, and by this process, such is the chemical action and re-action of the gases, that the carbon contained in the tar, oils, or fatty matters used, becomes fully saturated; and thus may be obtained the whole, or very nearly the whole of the carbon in the state of carburetted hydrogen gas. It is well known that different tars, oils, and other fatty matters, evolve, when decomposed, different relative quantities of carbon, hydrogen, and oxygen, consequently require the decomposition of more or less water to make up the deficiency, by supplying hydrogen and oxygen sufficient to saturate the excess of carbon, in order, under the most favourable circumstances, to produce carburetted hydrogen gas for the purposes of light. Care must, therefore, be observed, in making carburetted hydrogen gas from tar, or from particular oils, or from other fatty matters, to ascertain how much water the same will require to have decomposed. But as an analysis of all, or almost all of such matters, is to be found in most modern chemical works; it will not be necessary to enter more at large into this subject, farther than to remark, that one atom of carburetted hydrogen consists of two atoms of carbon, and two atoms of hydrogen. One atom of oxide of carbon consists of two atoms of carbon and one atom of oxygen; and as water, when decomposed, produces twelve per cent. of hydrogen, and the rest oxygen, it follows that, having ascertained the quantity of carbon, hydrogen, and oxygen, contained in the particular matter about to be employed in the manufacture of gas, the quantity of water required to be decomposed to make up the deficiency of hydrogen and oxygen, will be immediately known. And I would farther remark, that, in order to fully and most beneficially perform my invention, it is of importance that the retorts or apparatus employed, should be kept at a uniform heat, that is, at a bright white-red heat.

Description of the Drawing.

The drawing, fig. 1, represents the section of three vertical retorts, suitably arranged for performing my invention; and the furnace is suitably constructed for conveniently heating and maintaining the same at a uniform temperature; *a*, *b*, and *c*, being the three retorts, one for decomposing the tar or oil, or other fatty matter employed, another for decomposing the water, and a third for continuing the products of the water. It is not, however, material, which of the retorts is used for the separate duties, they being all similar.

In the arrangement shown, *a* is the retort in which the water is decomposed; *b*, the retort in which the tar or oil, or other fatty matter is decomposed; and *c* is the retort into which the gases evolved in the retort, *a*, enter, and are farther decomposed; the object being fully to decompose the water before the products thereof come into the retort, *b*, to combine with the products of the other retort; *d* is a vessel containing tar or oil, or other fatty matter; and *e* is a vessel containing water; *f f* are two syphon pipes, which enter into the upper parts of the retorts, *a* and *b*; and there are cocks on the vessels, *d* and *e*, to regulate the supply. The nature of the retorts, which are of cast iron, is clearly shown in the drawing, each retort having a projecting or descending tube, *g*, connected at the lower end thereof; within which the gratings, which are similar to fire-bars, can be raised and lowered, and the coke or charcoal in the retorts rests on these gratings, which allow of the passage of any small ashes or dust of the coke. The arrows indicate the direction of the gases, in and from the respective retorts; and the pipes, *h i*, connect the retorts, *a* and *c*, and *b* and *c*, as is clearly shown in the drawing; and, in using this apparatus, the three retorts are filled from above, with coke or charcoal, and then the ends of the retorts are to be closed, and all things arranged, as shown in the drawing. I would here remark, that although I prefer that the retort, *c*, should contain charcoal or coke, this is not absolutely necessary; and it should be understood, that I prefer the use of coke in consequence of its cheapness, and the retorts are charged with fresh coke every twenty-four hours; and I have found that I am thereby enabled to retain the temperature required more readily, the retorts being at a good red-white heat; the tar or oil, or fatty matter, and also the water, is to be permitted to flow, observing that the water is allowed to drop, in proportion to the requirement of the other matter employed; and as it is difficult to arrange apparatus to perform this operation with nicety, and as the syphon tubes might become more or less stopped in working, the simplest and the best practical means I am acquainted with for regulating the supply of water to the requirements of the matter employed is, to have a lighted gas-burner near the retort, and within sight of the workman; by this means he will, from time to time, be enabled to observe whether the result of his working is according to the desired object; and if he observes that the flame becomes more coloured than is proper, it will indicate that too little water is being supplied; and by this simple means, the workman having once set it right, the working will go on correctly, unless some impediment is offered to the supply of the matter employed or the water: *j* is the gas-pipe leading to the gasometer; for it should be understood, that carburetted hydrogen gas thus manufactured, will not require purifying, which is an important advantage appertaining to this mode of working. It should be stated, that the matter I generally employ, and, according to the cost of the various matters above mentioned, will, I believe, be most advantageous, is coal-tar; and, I would farther observe, that, although I prefer the arrangement of apparatus herein described, for the purpose of decomposing the matters and water employed, I do not confine myself thereto, provided the mode and process of working be retained as herein described.

I will now proceed to describe the second part of my invention.

Fig. 3 shows an external view of a gas-burner or apparatus for consuming gas, constructed according to this part of my invention; and,

Fig. 4 is a section thereof. On examining the drawing, it will be seen, that the outer surface of the upper part of the burner, *a*, is coned, as indicated from a^1 to a^2; in other respects it is of the ordinary construction; and *b* is an outer cone, which carries the gallery for the glass chimney, consequently the supply of air for the external of the flame will pass between the burner, *a*, and the cone, *b*; and owing to the upper part of the burner being in the form of a cone, the air will rush up in a direction to pass through the flame, and, by this means, effect a more perfect combustion of gas supplied to such arrangement of apparatus.

MORRICE'S IMPROVED METHOD OF MANUFACTURING BOOTS AND SHOES.

(Abstract of Specification.)

The invention consists in a mode of manufacturing boots and shoes, whereby the labour of sewing is dispensed with, and they are rendered more durable, and the feet are kept more free from damp and wet, than with shoes or boots of the ordinary description. In manufacturing boots or shoes, I take the under sole of the required size and form, and place it on the last, over which is brought the vamp or upper leather, which is pierced with a series of holes at the lower part, as shown

in the drawing; into these holes is put a thin cord, by the lacing of which, the upper leather is drawn tightly over the last. It will be seen that the vamp has also another series of holes, the purpose of which will presently be explained. Before drawing the cords of the vamp together, I place between it and the inner sole, either a plate of metal, or cork, or dissolved India-rubber, or any other suitable material which will prevent the wet from affecting the feet. When the upper leather is drawn together, I, with an ordinary shoemaker's hammer, press down the cord, which would otherwise present an uneven surface; when this is completed, I apply it to the outer sole, fig. 2; this sole is screwed on the boot or shoe by means of screws, which would fit into the holes made through the vamp; the heel is afterwards added in the ordinary manner of manufacturing boots and shoes. It will be seen by the drawing, that the screws here shown are somewhat different from the ordinary wooden screws, inasmuch as the heads are formed differently, being longer, and the cut in them is also deeper; the object of this is, that as the leather of the sole wears away, they may be the more easily removed.

Fig. 1 represents a view of the underside of a boot or shoe, showing the manner of fixing the vamp or upper leather to the sole; the same letters of reference denote

FIG. 2.

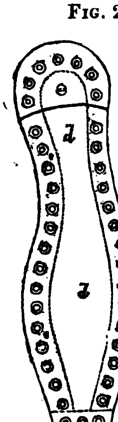
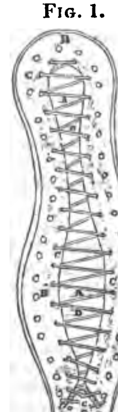
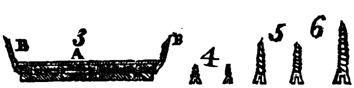


FIG. 1.





similar parts in each of the figures wherever they occur. A is the under sole of the boot or shoe; B is the vamp or upper leather; C, the holes through which the cord passes, to draw the upper leather together; D, the lacing-cord.

Fig. 2 shows the exterior sole before it is screwed on to the other part of the boot or shoe; *d* and *e* represent the holes through which the screws pass, to fix the soles together.

Fig. 3 represents a section of the boot, showing the mode in which they are fixed together.

Fig. 4 shows the screws for attaching the soles together; and,

Figs. 5 and 6, the screws for fixing on the heels.

It will be evident that this invention may be also applied to those descriptions of coverings for the legs which have soles attached to them; the mode of its application being the same as above described, it will not be necessary to repeat the description of it.

Enrolled April 17th, 1840.

ON THE CONSTRUCTION OF SUNDIALS.

(Continued from page 118.*)*

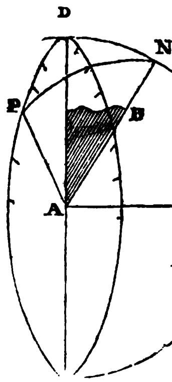
THE next in order is the north dial; that is, a dial whose face points to the north. This dial, however, can only be of use before six o'clock in the morning and after six in the evening; and, similarly, a dial whose face points to the south, can only point out the hours between six in the morning and six in the evening. However, I have in both cases given the angles which the stile would make, if it were possible, with the line from which the other angles are measured. This I have done, in order that persons wishing to complete the whole face may be able to do so; though, of course, these extra lines will be of no use, farther than giving a more finished appearance to the dial.

Let, as before, D I be the dial plate, the line, D A, being vertical; whence at midnight, the shadow should fall at A D (A B being the stile), whence the angle, D A P, will be the angle made by the hour-line, with the vertical line, D A. Then N O will be the latitude of the place, and D N P, the hour angle; whence, for same reason as before,

$$\text{Sin. } DN = \text{tan. } PD \,.\, \text{cos. } DNF;$$

$$\text{Or, tan. } PD = \text{sin. } DN \,.\, \text{tan. } DNP.$$

FIG. 1.



But D N is the complement of N O; that is the complement of the latitude; then if P D be represented by H, D N P by h, and O N by λ, we have

$$\text{Tan. H} = \cos. \lambda \,.\, \tan. h.$$

Whence, making h successively equal to 15°, 30°, &c., we have for Greenwich,

(1.) Tan. H = cos. 51° 29′ . tan. 15°
= tan. 9° 28′

(2.) Tan. H = cos. 51° 29′ . tan. 30°
= tan. 19° 46′

(3.) Tan. H = cos. 51° 29′ . tan. 45°
= tan. 31° 55′

(4.) Tan. H = cos. 51° 29′ . tan. 60°
= tan. 47° 10′

(5.) Tan. H = cos. 51° 29′ . tan. 75°
= tan. 66° 43′

(6.) Tan. H = cos. 51° 29′ . tan. 90°
= tan. 90°

(7.) Tan. H = cos. 51° 29′ . tan. 105°
= tan. 113° 17′

(8.) Tan. H = cos. 51° 29′ . tan. 120°
= tan. 132° 50′

(9.) Tan. H = cos. 51° 29′ . tan. 135°
= tan. 148° 5′

(10.) Tan. H = cos. 51° 29′ . tan. 150°
= tan. 160° 14′

(11.) Tan. H = cos. 51° 29′ . tan. 165°
= tan. 170° 32′

(12.) Tan. H = cos. 51° 29′ . tan. 180°
= tan. 180°

Whence, for

A.M.	P.M.		°	′
Midnight or 12		the angle, D A P, must be	0	0
1	— 11	....	9	28
2	— 10	....	19	46
3	— 9	....	31	55
4	— 8	....	47	10
5	— 7	....	66	43
6	— 6	....	90	0
7	— 5	....	113	17
8	— 4	....	132	50
9	— 3	....	148	5
10	— 2	....	160	14
11	— 1	....	170	32
12	— noon	....	180	0

We are compelled, through want of space, to defer till our next the remainder of this paper.

ON ELECTRICITY.

NO. IV.

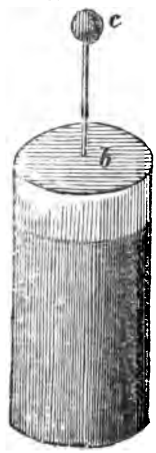
(Concluded from p. 100.)

WE have hitherto only spoken of the phenomena, and those experiments which can be illustrated by means of the electrical machine alone, by which it will be understood that we mean by small supplies of electricity; but we must now turn for a moment to the consideration of a law, without which none of the powerful effects of this fluid could be manifested; without which we must be content only to surmise what might be done by means of accumulated electricity. We are, however, not left in the dark upon this subject; the law which reveals it, and which we are now to consider, is termed the law of induction. When a body, as the prime conductor of the machine, for instance, is charged with electricity, and insulated so as to prevent the escape of that electricity, this fluid will remain perfectly quiescent, if at a distance from all other bodies; but if a conducting body be brought into contact with it, or within striking distance, the whole of its electricity will be carried away by it, accompanied with a spark; should, however, this body not be brought sufficiently near to carry away the electricity, with a spark (or by transference) it would still not remain perfectly quiescent, but induce in such body, and on the side nearest the conductor, a state of electricity opposite to its own; and on the side farthest from it, a state of electricity similar to its own.

For instance, if the prime conductor were charged with positive electricity, it would induce in an insulated metallic cylinder in its vicinity, and on the side nearest it, negative electricity, and positive on the side farthest from it. If, however, the prime conductor were charged with negative electricity, the electrical states into which the cylinder would be

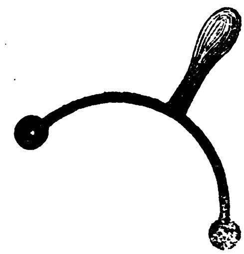
thrown, would be exactly the reverse of the above.

Advantage is taken of the above law for the construction of Leyden vials, by which we are enabled to accumulate almost any amount of electricity. The annexed figure is a representation; but before we proceed, it may be as well to observe, that this law will act just as effectually through an electric or a plate of glass, as if no such substance had intervened.



a is a glass bottle,* open at the top, coated on the inside and outside, about three parts of the way up, with tinfoil. It is furnished with the lid, *b*, of baked mahogany, through the middle of which passes a metallic rod, communicating with the interior coating, and furnished, at the upper extremity, with a knob, *c*. The method of changing it is as follows:—Take the bottle in the hand, and bring the knob to the prime conductor of the machine when in action. The electric fluid passes along it to the inner coating, which is thus rendered positive; at the same time, the electricity of the outer coating is carried away by the hand, the law of induction rendering it negative. When nearly coated, if by means of some conducting body, as a pair of discharging rods, a communication is made between the outer and inner coatings, or, in other words, between the positive and negative states. The electricity will rush from the former towards the latter, accompanied with a vivid flash and an explosion, or what is more generally known by the name of the electric shock, and the equilibrium will be at once restored.

The discharging rods of which we just now made mention, consist of a semicircular rod of brass, with a knob of the same metal at each extremity, and a glass handle attached. The annexed engraving is a representation.



When one knob is brought into contact with the negative coating of a Leyden jar, and the other to the knob, which communicates with the positive coating, the discharge is instantaneously effected, and the glass handle prevents the operator suffering any inconvenience.

During an electric explosion, a considerable degree of heat is evolved, which is sufficient even in a small Leyden vial to ignite most inflammable substances. If a little wool, sprinkled with powdered resin, be loosely tied to one of the knobs of the discharging rods, it will, when the vial is discharged, be instantaneously ignited. Turpentine, ether, spirits of wine, may also be included among the list.

The number of experiments similar to the above, or varied in their character, which may be performed by means of a single Leyden jar, are numerous; but an enumeration of them would exceed the limits of these brief papers; and, in concluding them, we would recommend to those who wish to know more of the subject, treatise in two parts on electricity, published under the superintendence of the Society for the Diffusion of Useful Knowledge. It is one which enters fully into the subject, and may be had of Baldwin and Co., Paternoster Row.

LIFE ASSURANCE.

NO. VII.

SOCIETIES IN LONDON.

THE societies of London are sufficiently numerous to present our readers with a fair outline of all the systems that are abroad for Life Assurance. Without dilating on the subject, it may briefly be observed, that the following lists of offices have been derived from the printed particulars put forth by themselves; and as nothing particular occurs in the first list worthy of remark, we would only notice

* I would advise all to whom economy is an object, to purchase an uncoated Leyden jar, which may be had at Ward's, Bishopsgate Street, and coat it themselves. With a little practice they will soon become expert at it, and it will be found to be a considerable saving. This is the plan the writer adopted, and he found his jars to answer in every respect as well as those ready purchased.

to the reader, that they are here placed with the dates of their institution—the first class wholly consisting of societies which devote none of their profits to assurers, but to the shareholders only.

Date.	Name of Society.	Whether Fire or Life.
1722	Royal Exchange........	Both
1796	West Middlesex........	Both
1797	Pelican	Both
1803	Globe	Both
1805	Albion................	Both
1826	Promoter..............	Life
1834	Argus	Life
1834	London and York	Life
1836	Standard of England....	Life
1837	Britannia	Life
1838	Benevolent	Both

Those which come secondly under our notice, are the mixed Proprietary Societies, which have made promises of a division of profits in part, with such of their assurers as have paid the premiums stated in their profit scale. Generally, the promise is two-thirds of profits, after the shareholders have taken their portion, and the interest of a borrowed capital, with other contingent expenses, have been paid!

Date.	Name of Society.	Periods of Division of Profits.
1710	Sun	7 years
1714	Union	7 ditto
1721	London Assurance	Annually
1792	Westminster	Annually
1797	Palladium	7 years
1805	Caledonian	7 ditto
1806	Provident...........	7 ditto
1806	Hand in Hand	6 ditto
1806	Rock	7 ditto
1807	Eagle	7 ditto
1807	Hope	7 ditto
1807	West of England	5 ditto
1808	Norwich Union......	7 ditto
1808	Atlas	7 ditto
1809	North British	7 ditto
1819	European	7 ditto
1820	British Commercial ..	7 ditto
1820	Imperial	10 ditto
1821	Guardian............	7 ditto
1823	Economic	5 ditto
1823	Law Life............	7 ditto
1824	Crown..............	7 ditto
1824	Alliance	5 ditto
1824	Scottish Union	7 ditto
1824	Asylum	5 ditto
1825	University	5 ditto
1825	Clerical, &c.	5 ditto
1830	National	Annually
1834	Universal	Annually
1835	Protector	5 years
1836	Minerva	5 ditto
1836	Licensed Victuallers' ..	5 ditto
1836	Legal and General	7 ditto
1836	Independent	7 ditto
1837	National Loan Fund ..	Annually
1837	Protestant Dissenters'..	—
1837	Naval and Military ..	7 years
1838	Victoria	7 ditto
1838	National Endowment..	—
1838	United Kingdom......	7 years
1839	Mercantile Travellers'	5 ditto
1839	Alfred	5 ditto
1839	Freemasons'	After 1843
1839	Westminster Mutual ..	Annually
1840	Australasian & Colonial	—
1840	Active	—
1840	Ark	—
1840	Church of England....	—
1840	Farmers and General..	—
1840	New Equitable	—
1840	Reliance	—
1840	Scottish Law Life	—

The foregoing constitutes the chief number of offices open for assuring lives in London, with but very little difference in their mode of transacting business, or treating their assurers; their grand aim being to compete with each other in the cheapness of their rates, and invite the unwary public by every flattering announcement, both in their prospectuses and by advertisements, that can possibly be set forth—each contending its *own* superiority.

Now from our brief table it is worthy of remark, that a vast difference is observable in the periods of divisions of profits with a few, compared with the rest. There is but a slight disparity, if any, in the prices named by each for assuring 100*l.*; but yet few have afforded the public the advantage of an annual division of profits, compared with those who have fixed their periods from five to seven years and upwards. Although, strictly speaking, this is not to be the criterion for selecting from the above offices, inasmuch as the expectation of a person assuring in any of them, cannot be supposed to be great; well knowing, as he ought, if he does not, before entering them, that their *profit-takers* are their proprietors, and not their assurers.

For an example, what can the reasonable expectation of a person be, who assures in "The National," when he sees

their direct aim is to crush the idea in the minds of the public, that a mutual society is of the best advantage to assure in? And, then, by way of taking the profits, to distribute them chiefly among their proprietors, assert with modesty, that they give their assurers "freedom from all responsibility," and numerous other privileges. And what, may we ask, do those privileges consist of? Why this—that "two-thirds of one-fifth" of their profits should be divided annually, being, in reality, not *one-seventh part* of their gains; yet, for this promise, an assurer is taxed upon a higher rate of premium, before he can be allowed to enjoy so important an advantage. We look at the equity of the thing. But, then, upon this plan of dividing but so small a share of profits, that they are not worthy the name, are others established, such as "The Minerva," "The Licensed Victuallers'," "The National Loan Fund," "The Victoria," and several others of later date; and, we hope, it will be seen, that, rather than have placed them with the older mixed Proprietary Companies, whose mode of division is of a different kind, we ought, in justice to the public, to have set them on one side.

(*To be continued.*)

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, Aug. 19, E. W. Brayley, Jun., Esq., on Igneous Geology. Friday, Aug. 21, H. Brown, Esq., on the Preparation and Adaptation of Corneous Substances to the various purposes of Commerce. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street. — Thursday, Aug. 20, S. C. Horry, Esq., on Juries. At half-past eight.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, Aug. 19th, Mr. E. W. Plews, on Galvanism. At eight o'clock.

QUERIES.

The process of preparing horse-hair, such as I have seen in the sieve-makers' shops in London; viz. how they get it so straight, and with the roots all one way? Also, the method of curling horse-hair for stuffing sofas, &c.? A. B. M.

How to make a paste or composition which, when laid on paper and afterwards dried, will, on applying slight moisture (as of the tongue) render the paper perfectly adhesive? Q—Y.

The best and simplest method of making an electrotype apparatus? Also, the easiest way of detaching the precipitated metal from the original plate? Q—Y.

Having a large quantity of acid porter, I am desirous of converting it into something saleable, if possible—say vinegar; but being unacquainted with the process of its manufacture, I wish to know how to proceed, and how to take away the colour. Perhaps some of your correspondents could favour me with the most approved method of manufacturing this article from malt, sugar, &c., and the strength generally made by saccharometer to produce the numbers 18, 20, 22, and 24, as sold by the trade. H. SHERMAN.

The best plan for making a gymnastic pole, and the manner the ropes are fixed to it? Also, in what manner the ropes are fixed, which the parties leap over in running round? FRANK.

The best and easiest method of gilding picture-frames? A. G.

TO CORRESPONDENTS.

P. Truman.—*We shall avail ourselves of the papers he has sent us as early as possible.*

A. G.—*Try a strong infusion of tobacco.*

S. M. C. *asks*, "*Is it possible to determine* accurately *the precise moment when the sun reaches its meridian, on a wet or cloudy day, and the sun consequently invisible?*" *The exact time at any place of* known latitude, *may be ascertained by an accurate chronometer; but such computation must, of course, be subject to the error of the machine. If the latitude be not known, there are no means of finding the meridian on a cloudy day.*

G. B. *next week.*

J. Banks *will find his query answered in another column of the present Number.*

J. M. K.—*Shoemakers' heel-balls are composed of rosin, bees' wax, linseed oil, and lamp-black; the proper proportions must be found by experiment. Ullathorn's are the best; but the exact process he employs is not known, as none have been able to equal them. His other queries shall be attended to.*

J. S.—*Early youth is unquestionably the most favourable period for the commencement of study; but remember* "you are never too old to learn." *Many men, who have risen to great eminence, commenced their chief studies so late in life as thirty, forty, and even a still more advanced age. Socrates, Plutarch, Cato, and many others, commenced new studies in their old age; L. Monaldesco wrote a book at the age of 115, and La Casa said he* thought *he should write sonnets twenty or thirty years after his death.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by DOUDNEY & SCRYMGOUR (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

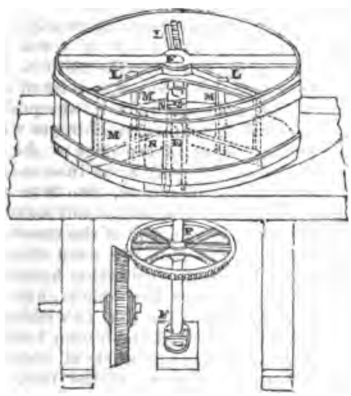
THE

MECHANIC AND CHEMIST.

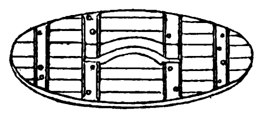
A MAGAZINE OF THE ARTS AND SCIENCES.

No. 106, NEW SERIES. | SATURDAY, AUG. 22, 1840. PRICE ONE PENNY. | No. 227, OLD SERIES.

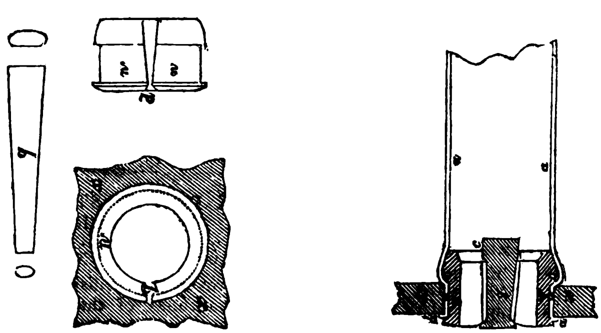
RICHARDSON'S PATENT PROCESS FOR THE PREPARATION OF SULPHATE OF LEAD.



COVER OR LID.



WAHL'S PATENT STEAM-ENGINE BOILER.



City Press, 1, Long Lane: Doudney and Scrymgour.

RICHARDSON'S PATENT PROCESS FOR THE PREPARATION OF SULPHATE OF LEAD,

Applicable to the purposes for which Carbonate of Lead is chiefly employed.

(Abstract of Specification.)

I USE protoxide of lead, as it usually occurs in commerce, and prefer what is known as flake litharge, which is put into the tub hereinafter described, where it is mixed with a quantity of strong acetic acid, in the proportion, and of the strength, after mentioned, and a quantity of pure water, sufficient to render the whole moist; the mixture thereof is effected by the agitation hereinafter explained, which is continued sufficiently long to enable the acetic acid to act upon the protoxide of lead, and to convert a portion of it into an acetate of lead. I use acetic acid, of the specific gravity 1.046, or thereabouts, in the proportion of one part to fifty, six parts of protoxide of lead, and I operate upon one ton of litharge—this proportion is the most economical; but a larger proportion of acetic acid may be used. The agitation is continued; and when a portion of the protoxide of lead is converted into acetate of lead, I begin to pour into the tub, through a leaden or other convenient pipe, sulphuric acid, of the specific gravity 1.5975, or thereabouts, at the rate of about one pound per minute, until a quantity of sulphuric acid has been added sufficient to convert all the protoxide of lead into a sulphate of lead. This quantity must be in the proportion of twenty parts absolute sulphuric acid to 112 parts of protoxide of lead; but the proportion of sulphuric acid may be increased to forty parts. The agitation is continued until the whole of the protoxide of lead has combined with the sulphuric acid added, when the sulphate of lead thus formed is removed to convenient troughs, where it is washed free from all foreign substances. After the washing is finished, it is ground in water, and then dried in stoves similar to those already in use in manufactories of white lead; this sulphate of lead thus made will possess a body, and is applicable to some of the purposes for which carbonate of lead is now applied—to wit, painting, glazing, pottery ware, &c. The apparatus which I recommend to be used for the agitation, hereinbefore described, is as follows, viz.:—

Description of the Drawing.

A circular wooden tub or vessel, as shown in the drawing (see front page), of the depth of about two or three feet, and about six or seven feet in diameter, completely lined with sheet-lead, and covered by a lid. This vessel should be raised a convenient height from the floor of the apartment in which it may be placed, so as to allow the machinery for agitating the materials, sufficient working space underneath. In the centre of the bottom of the vessel should be fixed, pointing upwards, and perfectly water-tight, where it joins the leaden lining, a leaden tube or boss, E E, about eighteen inches high, and of a diameter sufficient to allow an upright shaft, F, to pass through. This upright shaft, F, is fixed in the ground, or in the floor of the apartment, in a footstep, so as to be easily moveable, and passes up through the bottom of the wooden tub through the tub or boss, E, nearly to the lid of the tub, into a bar of wood fixed across the tub, to steady the motion. Near to the top of the shaft, F, are fixed three horizontal arms of iron, L L, at equal distances from each other, reaching to within about two inches of the sides of the tub; into each of these are arms inserted, and fixed by means of screws, two iron rods, M M, reaching to within about an eighth of an inch of the bottom of the vessel. To the ends of the rods are fixed thin iron plates, N N, about two inches broad, and of a length to reach from one-eighth of an inch to the side of the tub, to within one-eighth of an inch of the leaden boss, and sloping forwards at an angle of about 25° or 30° to the bottom of the tub. The whole of the machinery inside the tube must be covered with sheet-lead, to protect the same effectually from the action of the acids. The upright shaft, F, is made to revolve by a bevel cog-wheel fixed near to its lower end, working into another bevel cog-wheel attached to a shaft, worked by steam or any other power, by which means the machinery is made to revolve inside the tub, and agitate the materials in a very perfect manner.

Enrolled June 9th, 1840.

WAHL'S PATENT STEAM-ENGINE BOILER.

(Abstract of Specification.)

MY improvements consist in a mode of fixing the tubes of that description of boiler called tubular boilers, which are used for locomotive engines and for other purposes; whereby I am enabled to obtain the expansion or contraction of the tubes required, and in such manner as more completely to prevent their being displaced; and this is effected by placing at

the ends of the tubes what may be called split rings, which rings will be of various forms and sizes, according to the dimensions of the tubes to which they are applied.

According to this invention, the ring which enters the end of the tube is slit; and when within the tube, the ring is expanded by a wedge or key, as hereafter explained; and it is preferred that the ring should be grooved on the external surface. In case of its being required to take off one of the rings, the wedge or key is withdrawn, and the collar becomes free; it may be then withdrawn without any difficulty.

Description of the Drawing.

x represents a section of the boiler-plate; *a*, one of the tubes which fits in the opening formed in the plate; and it will be seen that the tube is bent at the end, as shown at a^1; *w* is a split ring, which is placed in the inner part of the tube, *a*, in order to close or fix it in the plate, *x*. The nature of the ring, and the opening to receive the wedge, will readily be understood by examining the drawing.

The wedge, *g*, fits into the inner part or slit, *c*, and closes it to the part, *d*; and when well pushed in by a rod or other means, it is cut off and rivetted at *d*; *o* represents the groove or recess around the ring, *w*. I would remark, that although I have shown the ring, *w*, to receive the wedge or key from the inside of the tube, it will be evident that it may be suitably formed by reversing the opening of the slit in the ring, and thus allow of the wedge being forced inwards; and in such cases it does not require to be rivetted.

From the foregoing description it will be seen, that the tube, *a*, will be caused to lap over the edges of the opening in the boiler-plate, and thus more completely prevent the possibility of movement or loosening of the tube, *a*; and the same will be rendered more water and steam-tight at its points of junction with the boiler-plate through which it passes; and I would have it understood that the ring, *w*, should be of the shape and figure shown. The same may be slightly varied, without departing from my invention, so long as the same is suitably arranged for receiving wedges to expand them outwards, and thus to make the diameter of the tube within the boiler somewhat larger than the hole through which it is passed. In the mode described, I have shown split rings with wedges; but I do not confine myself thereto, as it will be evident that rings, which are not split by the insertion of a wedge or mandril, may be used to produce the same effect.

Enrolled May 9th, 1840.

EDUCATION OF THE WORKING CLASSES.

To the Editor of the Mechanic and Chemist.

SIR,—The extent and position of the working class of this country at the present moment, is highly interesting to every person who admits the truism, that "labour is the source of wealth;" and that it should be the duty of a well-ordered government to exercise a kindly guardianship over that class of the community, whose welfare more or less affects the stability of the empire to which it belongs.

A class living by labour under ordinary circumstances, must be affected by the natural existence of *external* and *internal* difficulties, which must always, to a greater or less extent, retard the progress of intellectual improvement, which, next to the sway and operation of cheap and wholesome law, is absolutely identified with its prosperity and social elevation. The external difficulties result from the necessity of toiling during two-thirds of what may be termed the active day (in contradistinction to the passive, or what is appropriated to rest and sleep), for at best a hard-earned subsistence, which has to be doled out with care and economy, to meet the returning wants of seven days; and the fatigue of nature which, in most cases, accompanying the cessation from labour, leaves the mechanic at the close of the day, generally unfitted for sedentary employment or mental recreation. From these existing and outward circumstances are created the internal difficulties, arising from the neglect of individual education in youth, and the prevailing want of a taste for moral improvement, which generally accompanies the habits and feelings when wedded to ignorance and toil.

Thus situated by the force of circumstances, and with a large share of prejudice flung into the scale by the other constituent parts of society, the productive mass have been allowed to struggle on for years past, with all the custom-bound feelings which their restricted situation was peculiarly fitted to generate and cherish.

Emerging as from a thick gloom, the labouring population as a body are now, however, intuitively awakening from their lethargy. Thanks to the master spirits of

their order, the elevation of the working class has been held up as practicable, and, however daring to others it may appear, the philanthropist beholds in all the stirring principles of the day, which are emanating from the sons of labour, an honest desire to emancipate themselves from the trammels of ignorance; and, by uniting for mutual benefit and moral improvement, the abdication of the monster of intemperance, the destruction of the brand of depravity and degradation, they now claim for themselves a proper and rational footing in society, as respectable, useful, and enfranchised men.

What are all the political struggles of the day? What is the important scheme of erecting a *Trades' Hall* in the centre of London by 1*l*. shares among the operatives of the metropolis? What are the institutions of asylums for their aged and infirm brethren when past work, which are now promoting in almost every trade, but so many pleasing indications that the mind is expanding, the heart enlarging, and the intellectual condition of the working men of the country promising a glorious and speedy exaltation?

In London, as the capital of the world, the master spirit of mental enterprise has very aptly reared its throne; there the *Trades' Hall*, if successfully carried out, will concentrate the now divided mass, and bring it into closer sympathy and unity of action; instruct the children of mechanics in useful knowledge, that the next generation of artisans may come forth armed with all the intelligence and determination of educated men, and cement the bonds of society with a more equalized position mutually granted by all, as the stamina of the national wealth and honour. These principles, thus unanimously carried out by the great working population, will, consequently, invest with a moral dignity all the various institutions for their benefit, which are now carrying on: among these will rank pre-eminently *Trades' Halls*, for their welfare and instruction in the active years of their life; and *Provident Asylums* (such as the bookbinders of London are now anxious to erect) to shelter them in the closing days of life, to invest their path with comfort and peace, and screen them from the iron tyranny of pauper laws.

I am, Sir, yours respectfully,

WM. FARREN.

Trades' Hall Office, 16, Old Bailey.

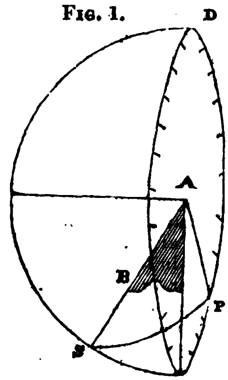
ON THE CONSTRUCTION OF SUNDIALS.

(Concluded from page 125.)

WE next proceed to the south dial; but as this is so nearly similar to the one we have just described, we shall merely point out the difference.

As the sun has attained its greatest elevation at twelve o'clock, noon, the shadow of the stile must be in the line, A I.

FIG. 1.



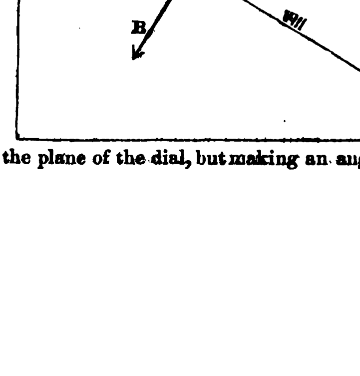
Whereas in the north dial it was in the line, A D; the line, S I, which is equal to D N, is also equal to the complement of the latitude. Whence, as before,

$$\text{Sin. } SI = \text{tan. } IP \text{ cos. } ISP;$$
$$\text{Or, tan. } IP = \text{sin. } SI \text{ . tan. } ISP;$$
$$\text{Or, tan. } H = \text{cos. } \lambda \text{ . tan. } h;$$

from which the same angles as before will be found.

In the construction of dials to face either the east or west, we only require a small rod, which can be suspended parallel to

FIG. 2.

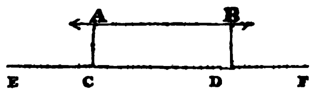


the plane of the dial, but making an angle

with the horizon equal the latitude of the place.

Thus let A B be a rod suspended at a short distance from the plane by two pins at A and B. Thus let fig. 3 be a section of the dial drawn through the stile perpen-

Fig. 3.

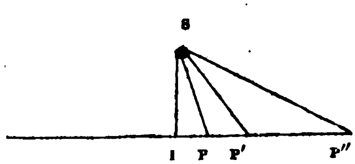


dicular to the plane of the dial, then A′ B′ will be the stile, and A′ C, B′ D its supporters; E F being a section of the plane of the dial.

As the sun revolves round the heavens, it is evident that it must describe a path which, towards the east and west, will appear a straight line; the line, therefore, upon which the hours are marked, must be a line perpendicular to the right line joining C D, the feet of the perpendiculars from A B, the point directly under the stile, denoting six o'clock, either morning or evening, according as the dial is east or west.

Let fig. 4 be a section of the dial perpendicular

Fig. 4.



to the stile, A B; the point, S, will, therefore, be the section of A B. Then, by common property of right-angled triangles,

$$P\,I = S\,I \;.\; \tan.\, P\,S\,I.$$

$$P'\,I = S\,I \;.\; \tan.\, P'\,S\,I, \text{ \&c.}$$

That is, the lines P I, P′ I, &c., are proportional to the tangents of the $\angle$ I S P, I S P′, &c. But the angles, I S P, I S P′, are the angles described by the sun in a certain time; that is, if they be made successively equal to 15°, 30°, &c., by producing these lines, to meet the line I P′; that is, the dial plate, we have the distance passed over in each hour.

If we call S I = I, we have

		H.	H.
$P\,I = \tan.\ 15° = 0.268$; i.e.	for	5 or	7
$P'I = \tan.\ 30° = 0.577$	......	4	8
$P'I = \tan.\ 45° = 1.000$	......	3	9
$P'''I = \tan.\ 60° = 1.732$	......	2	10
$P''I = \tan.\ 75° = 3.702$	......	1	11

but tan. 90° = ∞; that is, the line would never meet the dial plate, and, therefore, this dial can only show the time near either the rising or setting of the sun.

J. A. S.

LIFE ASSURANCE.

NO. VII.

(Concluded from p. 128.)

Let us, for a moment, glance at one of these societies in the division of their profits. Let us suppose (as will be more just than exposing their error, by naming any one in particular) we ascertain that some one society has, by ways and means, accumulated 14,500*l.* in the shape of profit; this can be only done when their capital is properly invested; a thing, kind reader, you dare not ask some of them, or they would have to tell a direct lie. Suppose, then, this sum is put down at the year's end as *their* profit in total; see ye, to whom none of these secrets have been told before, how wisely will be their distribution among their members. We should not have said members—assurers.

Interest upon 50,000*l.* borrowed money, at five per cent.......	£ 2500
House rent and expense (considered a moderate sum)	2500
Advertisements (this is the average estimate)...............	2000
Paid directors for one year's attendance....................	1500
Salary of officers (perhaps)......	1500
Commissions	3000
Balance remaining	1500
	£ 14,500

Of the amount remaining, *two-thirds* has been stipulated as the profit for the assurers, the other portion to go to the share-holders, who, it will be seen, have already drawn 2500*l.* as interest upon the capital lent. Of the commissions which may at first sight startle the reader, we have more to say anon. Let us only, at present, beg the forbearance of the public for having led them to such length, with observations on a system of Life Assurance, which falls so short of *equity*, *philanthropy*, or even *common honesty*; and let us entreat them to make a just discrimination between those we have described, and the long-established and respectable offices which mingle with others in the foregoing list, where the same mode of deception is seldom, if ever resorted to. We are aware that, to examine their various prospectus will yield no clue to detection, but the exercise of a common-

judgment may. We now give a list of the Mutual Societies:—

Date.	Name of Society.	Periods of Division of Profits.
1706	Amicable	Annually
*1762	Equitable	10 years
*1806	London Life	Annually
*1815	Scottish Widows' Fund	7 years
1825	Scottish Amicable	7 ditto
1834	Mutual	Annually
1835	Metropolitan	5 years
1835	National Provident....	Annually
1840	Productive	Annually

It would be quite superfluous to give any detail of these societies, beyond what has been done before, farther than to observe, that it need not be wondered, when the non-mutual societies exceed in variety the mutual societies by more than seven times their number, that so little should have been known by the public, of a system of provision for their families at once so equitable and so great as mutual assurance.

We have seen many hundreds of benefit societies most eagerly embraced by the public, simply because no acts of theirs were kept secret from the several members; and will it not be believed universally, that when a society presents to its assurers, as does a mutual society, all its overplus gains every year, and exhibits to every member the real transactions of the society, which is the surest testimony of its stability and honesty; and, farther, when every member has the same prerogative given him in the management of its affairs, whenever a meeting is called for business—will it not be believed, we ask, that to the parent whose solicitude is a provision for his family, a way is opened superior to all others he found before, and which he will warmly greet? And we also believe, where *one* father has now secured—convinced that it is a sacred duty incumbent upon him—a dependance for his widow and his fatherless children; when that hour shall come, *thousands* will fly to the advantages which are every day offered for this purpose, when the objects of Mutual Societies are better known and more encouraged in their laudable undertakings; since it is a fact, that this is the only system that will or can ever lead the public to partake largely of the benefits of Life Assurance. SIGMA.

* These do not give all their profits at each division.

HISTORY AND DESCRIPTION OF THE LONDON AND BIRMINGHAM RAILWAY.

(*Continued from page* 103.)

Here commences the last excavation on the line; it is a mile and a half in length, and forty-five feet deep, and crossed by various bridges. Emerging from this cutting, an embankment commences, a mile in length and thirty-eight feet high, containing 339,332 cubic yards of earth. From this position a view is obtained of the beautiful surrounding country, and the spires and gigantic chimnies of the far-famed and unrivalled Birmingham. A little farther on is seen the viaduct of the Grand Junction Railway, and crossing the Lawley Street Viaduct, 730¾ feet long, and 46¾ high, we enter the Birmingham station, 112¼ miles from London. At this station omnibuses are in attendance to convey passengers to all parts of the town; fare sixpence. There are also hackney-coaches and cars, but the fares are rather higher than in London.

Birmingham, sometimes called *Brumwycham* in old writings, was celebrated for its manufacture of iron articles by the earliest writers upon record. Mr. Hutton, the historian, is of opinion, that this manufacture existed at the time of the ancient Britons; and, in support of this assertion, remarks, that "upon the borders of the parish stands Aston furnace, appropriated for melting ironstone, and reducing it into pigs; this has the appearance of great antiquity. From the melted ore in this subterranean region of infernal aspect, is produced a calx or cinder, of which there is an enormous mountain. From an attentive survey, the observer would suppose so prodigious a heap could not accumulate in a hundred generations; however, it shows no perceptible addition in the age of man." Leland describes the appearance of Birmingham in the time of Henry VIII. as follows:—"The beauty of Birmingham, a good market town in the extreme parts of Warwickshire, is one streete, going up alonge, almost from the left ripe of the brooke, up a meane hill by the length of a quarter of a mile. There be many smithes in the town, that use to make knives and all manner of cutting tools; and many loriners that make bittes; and a great many naylers; so that a great part of the town is maintained by smithes, who have their iron and sea-coal out of Staffordshire."

From the Restoration to the present time, Birmingham has gradually increased in population and commercial importance,

and is now the greatest manufacture of almost every description of hardware goods in the world. To enter into a description of this vast emporium, would lead us beyond the limits and intention of this work; here, therefore, we respectfully take leave of "the courteous reader," leaving him to admire the perseverance, industry, and talent, which, from a small community of blacksmiths, have erected the greatest manufactory that ever existed, and obtained for Birmingham the appellation of "*the toy-shop of the world.*"

ITINERARY OF THE LONDON AND BIRMINGHAM RAILWAY.

(The principal Stations are printed in SMALL CAPITALS, and the intermediate ones in *italics*.)

[*The first column denotes the number of miles from London, and the second, miles from Birmingham.*]

MIDDLESEX.

EUSTON GROVE terminus	0	112¼
Camden Town, Park Street bridge	1	111¼
Primrose hill tunnel, 1120 yards in length	1½	110¾
Kilburn bridge	3¼	109
Kensal green tunnel, 320 yards in length	4¾	107½
Brent river viaduct	7	105¼
Harrow road viaduct	8	104¼
Kenton lane viaduct	10¼	102
Harrow Station	11½	100¾
Hatchend bridge	12¾	99½
Dove House bridge	13¼	99
Weald bridge	13¾	98½

HERTFORDSHIRE.

Oxhey lane bridge	14½	97¾
Watford heath	15¼	97
Watford heath bridge	15½	96¾
Coln river viaduct	16¾	95½
WATFORD STATION and bridge over the St. Alban's and Rickmansworth road	17¾	94½
Watford tunnel, one mile in length	18½	93¾
Hunton bridge and Leavesden green road viaduct	20	92¼
Primrose green bridge	21½	90¾
Nash mill iron bridge, over the Grand Junction Canal and river Gade	22	90¼
Viaduct over the London road	22½	89¾
Twowaters, Hemel Hempstead, and Bovingdon road viaduct	23	89¼
Boxmoor Station and viaduct over London road	24¾	87½
Viaduct over the Grand Junction Canal	25¼	87
Viaduct over the Berkhamstead and Hemel Hempstead road	27½	84¾
BERKHAMSTEAD STATION	27¾	84½
Northchurch tunnel, 360 yards in length	28½	83¾
Northcote Court viaduct	30¼	82
Wiggington and Aldbury viaduct	31	81¼
TRING or PENDLY STATION at Tring summit, and Tring and Aldbury viaduct	31¾	80½

BUCKINGHAMSHIRE.

Pitstone green	34¼	78
Seabrook bridge over the Grand Junction Canal	34¾	77½
Aylesbury Railway	35¼	77
Cheddington	36¼	76
Horton	37	75¼
Broughton Brook bridge	39¼	73
LEIGHTON BUZZARD or SOUTHCOTT STATION	40¾	71½
Linslade tunnel, 290 yards in length	41¼	71
Stoke Hammond viaduct	44¼	68
Fenny Stratford and Winslow road viaduct	45¼	67
Bletchly Station	46¾	65½
Denbigh Hall viaduct	47¾	64½
Woughton road viaduct	49	63¼
Loughton	50¼	62
Bradwell	51¼	61
WOLVERTON STATION and viaduct	52½	59¾
Castlethorpe	54½	57¾

NORTHAMPTONSHIRE.

Ashton	58¾	53½
ROADE STATION	60	52¼
Blisworth Station	66¼	50
Grand Junction Canal viaduct	63	49¼
Bugbrook viaduct	66½	45¾
Stowe tunnel, under the London and Birmingham road, 400 yards in length	68¼	44
WEEDON STATION	69¾	42½
Brockhall bridge	71¼	41
Whilton bridge	72½	39¾
Long Buckby viaduct	73½	38¾
Grand Union Canal viaduct	74½	37¾
Crick Station	75¼	37
Kilsby tunnel, one mile and 640 yards in length	76¾	35½

WARWICKSHIRE.

Hill Moreton viaduct	79¼	33
Clifton viaduct	82¼	30
RUGBY STATION	83¼	29
Long Lawford	85	27¼

Church Lawford	86¼	26
Brandon Station and viaduct	89¼	23
Brandon bridge............	89¾	22½
Sow viaduct	90¼	22
COUNTY OF COVENTRY IN WARWICKSHIRE.		
Sherborne bridge	92	20¼
Viaduct over the Coventry and Southam road...........	92¼	20
COVENTRY STATION	94	18¼
WARWICKSHIRE re-entered.	75¼	17
Fletchamstead	95¾	16½
Beechwood bridge..........	98¼	14
Beechwood tunnel, 160 yards in length................	98½	13¾
Docker's lane bridge........	99¼	13
Berkswell bridge	99¾	12½
Wooton green viaduct	100¼	12
Blythe river viaduct........	102¼	10
Hampton Station and Birmingham and Derby Junction Railway	102½	9¾
London and Birmingham road bridge	104	8¼
Marston green viaduct	105	7¼
East Hall viaduct	105½	6¾
Sheldon viaduct............	106½	5¾
WORCESTERSHIRE entered	107½	4¾
Stichford bridge over the river Cole, and re-enter WARWICKSHIRE	109	3¼
BIRMINGHAM TERMINUS	112¼	0

NEW MODE OF PROPELLING STEAM-BOATS.

FALKIRK, July 7.—An ingenious mechanic, residing at Grahamstone, has been for a long period engaged in constructing a small vessel, to be propelled by means of pressure-pumps; the application of a principle quite new to the scientific world. On Monday evening the boat was launched into the Forth and Clyde Canal, at Bainsford Bridge, and proceeded beautifully along the reach at a rate of not less than fifteen miles an hour, conducted by the inventer alone, who worked the pumps. He is so much satisfied with his first experiment, that another on a larger scale is forthwith to be undertaken, and a patent procured to protect the invention. He has no doubt that it will, at no distant era, entirely supersede the present mode of propulsion by means of paddle-wheels.

Extraordinary Discovery.—We have heard that an humble Frenchman has found the means of fixing the electric spark for public lighting; and that it can produce a permanent flame of thirty inches in diameter, which would light a great part of Paris. The only danger attending it is said to be in the apparatus of supply, which may be isolated; as it is so strongly charged, that a person touching it would be struck dead immediately. W. E. D.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, Aug. 26, E. W. Brayley, Jun., Esq., on Igneous Geology. Friday, Aug. 28, Election of Committee. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street. — Thursday, Aug. 27, S. C. Horry, Esq., on Juries. At half-past eight.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, Aug. 26th, Mr. H. Wiglesworth, on Heat. At eight o'clock.

QUERIES.

The method of preserving fish as nearly as possible resembling life? I have seen some in several rod-makers' shops in London, and wish to know the process.

A YOUNG EXPERIMENTALIST.

How to bleach sponge? I have tried sulphurous acid without a proper effect.

A. B. Y. Z.

TO CORRESPONDENTS.

A Young Experimentalist (Lancaster) *having written with that signature during the last eighteen months, and observing that another worthy correspondent has adopted the same cognomen, requests, for the sake of distinction, that the latter would choose another signature, should he favour us with any farther communications.*

J. T. B.—*Birmingham to London, per railway,* 1*l.* 12*s.* 6*d.*, 1*l.* 10*s.*, 1*l.* 5*s.*, *and* 1*l.*; *London to Calais or Boulogne per steam,* 15*s.*; *Calais or Boulogne to Paris, per diligence, from* 12*s. to* 24*s.*; *and* 4*s. or* 5*s. for conductor's fee. No railway.*

A Subscriber *next week.*

J. N. D. *will find ample directions for preparing photogenic paper in No.* 39, *N. S., Vol. IV.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by DOUDNEY & SCRYMGOUR (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

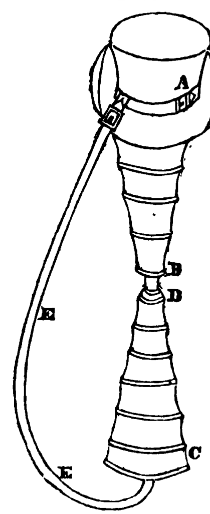
MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

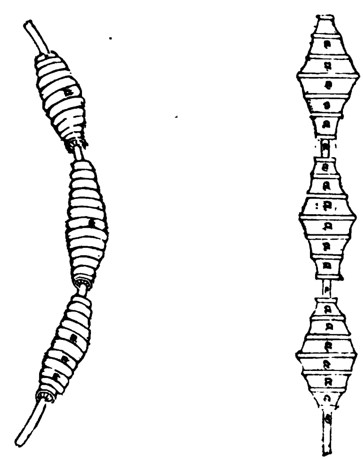
No. 107, NEW SERIES. | SATURDAY, AUG. 29, 1840. PRICE ONE PENNY. | No. 228, OLD SERIES.

FURNIVAL'S PATENT APPARATUS TO PREVENT PERSONS SINKING WHEN IN THE WATER.

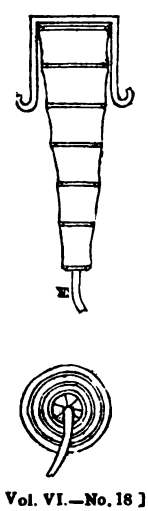
FIG. 1.



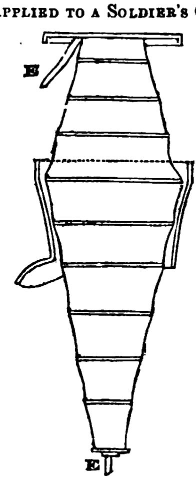
FIGS. 2.



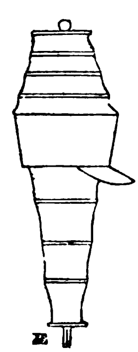
SECTION OF FIG. 1.



AS APPLIED TO A SOLDIER'S CAP.



AS APPLIED TO A BOY'S CAP.



City Press, 1, Long Lane: Doudney and Scrymgour.

FURNIVAL'S PATENT APPARATUS TO PREVENT PERSONS SINKING WHEN IN THE WATER.

(See Engraving, front page.)

The protection of life from fire or water, is a subject of too great and vital importance, to allow us to pass unnoticed any invention which appears likely to diminish the number of fatal accidents, which are almost daily recorded in different parts of the kingdom. As a hint for future improvements, as well as for the intrinsic value of the invention itself, we have procured for our readers the following abstract of Mr. Furnival's patent:—

"The invention relates, first, to the application of waterproof elastic bags or vessels to hats, bonnets, and caps, in such manner that persons may with facility use the same, in order to buoy themselves up when in the water, and can attach such bags or vessels to their persons with quickness, in the event of danger from shipwreck or otherwise; and at other times the apparatus is so arranged that the hat, &c., may be worn owing to the life-buoy or apparatus being within the hat, &c., and in no way interfering with the elegance of shape, and adds very little to its weight. I would remark, that I prefer the apparatus superadded to hats, should be of a fabric known as Mackintosh's waterproof fabric, and made as light as possible, by combining fabrics of as thin and close texture as possible.

And, secondly, the invention relates to a mode of constructing life-buoys more convenient for carriage when not in use, than those heretofore constructed; and such buoys can more readily and quickly be employed, owing to the same not requiring inflating by the blowing into the same.

Description of the Drawing.

Which represents a hat having the invention applied thereto; and I prefer that the inner lining of the hat, or the hat itself, should be waterproof, whereby the hat may become part of the buoyant apparatus. The bags or vessels which I prefer to have applied as the apparatus, are of a conical figure, as shown at fig. 1, from A to B, and from B to C; and such apparatus as shown, consists of bags or vessels of waterproof fabrics, having light hoops of cane or whalebone, or other suitable material, to keep the vessels or bags distended when drawn out of the hat, as shown in the drawing, and in such manner that they will pack close when folded into the hat. E is a riband or band, to attach the hat to any part of the dress; so that in the event of the person wearing the hat falling into the water, and the hat coming off, the same may not be separated from the person; on the contrary, when so attached, it would immediately become the means of support to the person. But in case of persons having time to prepare before being in the water, such as in cases of shipwreck, the apparatus is so constructed, as conveniently to be attached to the person by means of the strings or bands, E F; and such is the case in respect to persons in the water when they have presence of mind to draw the apparatus around them: the part from B to D is placed at the back of the person, and the hat and parts, C, is to be brought in front of the person, and the bands or strings, E F, being tied, the apparatus will be secured and held below the arms of the person, hence offering a life-buoy which will sustain and prevent a person in the water sinking.

Having thus explained the first part of the invention, I would remark, that the dimensions of the apparatus may be varied, depending on the weight of the person who is to use the same. And I would have it understood, that the shape of the apparatus or water-tight vessels applied to a hat, may be varied. In conclusion it will be evident, that although I have only shown the apparatus as applied to a hat, yet it will be readily perceived that a bonnet or cap, fitting the head of the person, may have the same description of apparatus applied thereto; the object of the invention being to apply suitable water-tight vessels of flexible materials in such manner, that, when out of use, the same will fold up and be within the hat, cap, or bonnet, and, at the same time, not interfere with the external shape of such hat, cap, or bonnet; for it will be seen from the above description, that it is only that portion of the hat, cap, or bonnet, into which the person's head enters, that is interfered with, in applying the invention, and so far the construction of hats, caps, and bonnets, is substantively the same; it will not, therefore, be necessary to enter into a farther description thereof.

The second part of the invention consists of constructing similar bags or vessels to those above described, as to be applied to hats, caps, and bonnets; but in this case they are separate, and may be folded together into a very small compass, and may be carried in the pocket or other convenient part of the dress.

Fig. 2 shows two such bags combined together, and having suitable strings or straps to fasten them round the person.

These bags consist of waterproof flexible fabric of as light material as possible, and there are a series of hoops of whalebone or other suitable material, *a a a*, to distend the bags when opened out, in order to prevent them collapsing when pressed on by the water, and the person to whom for the time they may be attached.

Fig. 3 shows one of these life-buoys folded up when out of use. When it is desired to use one of these life-buoys, all that is necessary will be to draw the same out to its full extent, when sufficient air will pass through some of the joints of the fabric, or some portion thereof, to fill the same; but I prefer that all parts of the apparatus may be as air-tight as possible, leaving means for the air to pass in only at a small waterproof tube, which will conveniently form one of the strings for fixing the apparatus, and the buoy so extended will be kept distended by the hoops, instead of by the force of air forced or condensed in waterproof bags; as is the case with bags or vessels which are now used as life-preservers, and which require inflating by the person blowing into the same, which requires much more time, care, and thought, than many persons in times of danger possess; while buoys constructed according to the invention, simply require to be drawn round the person and fastened, by which sufficient inflation is produced, the requisite distension being obtained by the hoops. And I would remark, that I have found that sufficient air passes through ordinary waterproof fabrics, which I have made into such bags, without any other provision for the air to pass in, when the buoy is being extended; but if the fabric be wholly air-tight as well as water-tight, provision is to be made for the passage of air into the interior, as above described, when the vessel or bag is being drawn out to its fullest extent."

TULK'S IMPROVED METHOD OF MANUFACTURING IRON.

(Abstract of Specification.)

According to the ordinary means now resorted to for manufacturing of iron, by smelting iron ores in blast furnaces, the description of ores known as argillaceous ores are, and have heretofore been, those which have necessarily been employed, notwithstanding their being exceedingly poor of metallic iron; and it is only from the circumstance of the poverty of such ores, that the process now resorted to can be worked with advantage in the manufacture of iron, by the use of pit coal, or coke, or anthracite; and such process of manufacturing iron from argillaceous ores, as now practised, is inapplicable to the making iron in blast furnaces from the rich ores or oxides of iron, known as hœmatites, found in Cumberland and other parts; and such ores have only been used heretofore in the blast furnace, to a very small extent, in conjunction with poor argillaceous ores, and, in some cases, with the cinder of reverberatory furnaces used in the manufacture of iron. I believe that such rich ores or hœmatites have seldom, if ever, exceeded one-tenth of the ores in the blast furnace at one time; the quantity, however, may be more. Now the nature of my invention is such, that iron may be made by the use of a blast furnace, wholly from the rich ores or hœmatites, or oxides of iron; or such rich ores may, with greater advantage, be mixed in larger, and, indeed, in any desired quantities, with argillaceous ores, than could be practised by the means ordinarily pursued in reducing argillaceous ores with slight admixture of hœmatites.

It is well known to iron-masters, in the process of smelting argillaceous ores in blast furnaces, that lime is used as a flux, and that the result of working is, first, the metallic or cast iron (carburet of iron), and a glass or slag, which is produced by the combination of the lime used as a flux, and the silica and other impurities of the argillaceous ores; and the furnace-manager judges by the appearance of the glass slag, whether his furnace is working as he desires, in order to produce the description and quality of iron he wishes to make, and he accordingly applies more or less lime, by which he insures the conversion of more or less of the ore into carburet of iron, and, consequently, the silica and the other impurities into glass; and such glass protects the metallic iron from the prejudicial effects of the blast. Now on an examination or analysis of the rich ores or hœmatites, they will be found to possess a very small proportion of silica or materials for glass-making; consequently, unless the requisite quantity of glass for protecting the metallic iron when separated, be obtained from some other source than itself, hœmatites cannot be employed in large quantities, even when mixed with poor argillaceous ores; because those poor ores cannot be advantageously worked, if the glass slag produced therefrom be proportionably much reduced from that which now results from the present working, which would be the case, if large quantities of hœmatites were to be used with a given

quantity of argillaceous ores. My invention, therefore, consists in employing glass, or materials for glass-making, in proportion to the hœmatites used in a blast furnace, by which means such rich ores may be reduced with facility and advantage, and the cast iron or carburet of iron protected by the requisite quantity of glass, and the glass slag obtained in the process may be used over and over again. And, I would remark, that I do not confine myself to the employment of any particular description of glass or materials for glass-making, in carrying out this my invention; as the same may be varied according to the materials which can be most advantageously obtained in the vicinity of the particular iron-works, where my invention is to be employed: thus nearly pure sand-stone with lime are the materials I have employed, because such sandstone and lime can conveniently be obtained by me near the works where I have matured my invention; but other materials may be used, such as the slag of glass-works, and the glass or slag from the blast furnaces of iron-works, obtaining such slag or glass as free from sulphur as possible. And I particularly mention these matters, because they have heretofore been treated as refuse matters in the works, and may, therefore, be had at small cost in comparison with other known materials for glass-making.

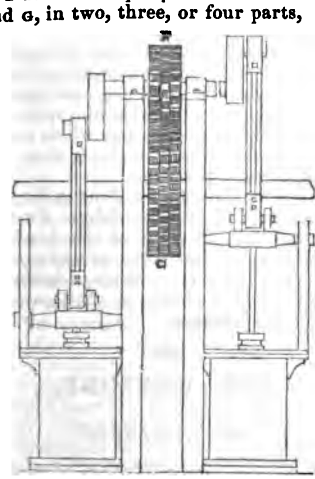
Having thus stated the nature and object of my invention, I will proceed to describe the means of making cast iron (carburet of iron) wholly from hœmatites or such like ores, by means of blast furnaces, as pursued by me; and in doing so I would remark, that the ores which I have worked with, are the Cumberland and Ulverston ores, which are very rich, and, on analysis, contain in one hundred parts of ore, about sixty-seven and two-tenth parts of iron, twenty-eight and eight-tenth parts of oxygen, only about four parts silica; consequently there would be very little glass slag produced by such a quantity of silica, when brought into combination with lime, or other proper material for making glass slag. And it should be stated, that in using more or less rich hœmatite ores, allowance is to be made for the quantity of silica and other impurities in the ores; and such is the case in respect to combining the use of hœmatite ores with argillaceous ores, in larger proportions than can now be done, when dependent on the glass slag, which will be produced from the silica and other impurities contained in the ores; but such allowance will readily be made in practice, after a little experience, the object being to employ such a quantity of lime or flux as will convert the whole of the silica into glass, and carry off other impurities, in order to prevent a silicate of iron being formed. In describing the process as pursued by me, I will suppose that the furnace used is an ordinary blast furnace; and I prefer to employ hot-blast. The glass mixture I have employed for smelting the very rich ores above alluded to, are ninety-three parts of silica to one hundred and one parts of lime; but I prefer to employ these fused into glass, to using the glass mixture in the blast furnace. According to the quality of cast iron I desire to make, I use more or less of the glass or slag, and I prefer in all cases to use the glass or slag to employing the matters for glass-making separately, before converted into glass; but, as before stated, the glass slag being once produced from this mixture, it may be used over and over again, the workman judging by the appearance of the slag, and applying lime as heretofore. In charging the furnace, I first throw in the coke, or coal, or anthracite, as usual, and then the glass or slag materials for glass-making is thrown in; then, again, the coke, and then the hœmatites or such like ores, broken small to about the size of hens' eggs, then more coke, &c., in this process, for a given yield of iron to that employed in reducing argillaceous ores. In charging the furnace wholly with hœmatites and with glass slag, I use about one part by weight of hœmatites to two parts by weight of glass slag, and if there be much silica in the hœmatites, I mix therewith some lime sufficient to convert the silex into glass, and carry off the other impurities. And it will be evident that, as the hœmatites contain more silica, and will, consequently, produce more glass from itself, the glass slag supplied into the furnace is to be reduced in proportion. The furnace in other respects is to be worked as heretofore practised.

ZANDER'S PATENT FOR IMPROVEMENTS IN STEAM-ENGINES, STEAM-BOILERS, AND CONDENSERS.

The first part of this invention is founded on the assumption, that there are a certain number of revolutions which the paddle-wheel of a steam-vessel ought to make in a given time, in order to obtain the most effectual re-action from the water, but always according to the velocity of the vessel's motion. In large vessels,

therefore, this number of revolutions becomes so diminished, that the velocity of the engine is lessened beyond the limit of convenient and profitable working. To remedy this defect, the inventer proposes to introduce a second motion, by means of which, the revolution of the paddle-wheel becomes relatively slower than in the ordinary construction, where the impulse is communicated directly from the beam, moved by the first power. This object is effected by means of cog-wheels of different diameters, varying according to the velocity required in the paddle-wheel, relatively to that of the engine. The lesser wheel is attached to the crank axle, and moves the larger one, which is fixed on the paddle-shaft. This mode of transmitting and modifying motion, is familiar to every one acquainted with machinery; and the inventer has not lost sight of the great difficulties attendant upon its application to the present purpose. Under the most favourable circumstances, the pressure upon the cogs must be immense; and the author acknowledges that the cogs must be very large, and, consequently, create much friction. He, therefore, proposes, in order to lessen this evil, a contrivance, the description of which we extract from his specification:—

"I divide the peripheries of the wheel, F and G, in two, three, or four parts, and



give to each cog in every part such a size, according to the power required from the engine to be by the wheel transmitted. Every cog in this division is fixed, so that, for instance, the peripheries are divided in four parts: one cog is a quarter before the joining cog in the peripheries of the wheel, divided in two parts; one cog comes, then, one-half of its breadth before the next cog, and so forward all with the divided parts; and the wheels are as, for instance, two, three, or four wheels being compounded. The wheels act, then, on each other, as if the pitch of their teeth had been two, three, or four times less, whereby you obtain a great advantage in having a less friction, but sufficient strength in the wheel teeth is gained. The wheel, G, is of a larger size than the wheel, F, according to the speed the engine should have over the paddle-wheel."

We cannot anticipate much advantage from this arrangement; and we think that Mr. Zander has underrated the pressure to which the cogs would be exposed, especially in a rough sea, and doubt whether any practical engineer would venture to adopt the plan.

The boiler is composed of a series of thin cast-metal chambers, very similar to Mr. W. Hancock's patent. (See "Mechanic," Vol. III. No. 112, O. S.)

The refrigerator is placed in a vessel filled with water, or other cooling medium, and the eduction steam from the working cylinder enters through a pipe, and being condensed into water, goes out through another pipe into the air-pump. The sides of the refrigerators are made of copper plates and of brass, "the distance between them being about half-an-inch, and, in order to keep them at this distance, and not to be pressed by the air, copper slips are applied half-an-inch wide, and placed edgeways and bent between the plates. The above-mentioned slips of plate are fixed in such a way, that their surfaces may detain the condensed water for so long a period as is possible during its descent. This is best effected by the slips being solely furnished with holes, or are folded in several separate places. The water that is formed by the eduction steam can only in a slow degree run down these slips, and form a water-surface on both sides of the slips, which is not even, but consists of great numbers of elevations and cavities. But in order still farther to detain this water surface, there are fixed between each row of slips, twisted brass or copper wires, from which the condensed water runs from and to them, and to and from the slips, and is formed into an infinite number of drops, and a constant circulation of the water is occasioned; which circumstance, as well as this great surface, is produced by this operation, and takes from the eduction steam its heat, and perfectly cools it when the valves are open, and before the piston reaches far on its way, but likewise easily

to deliver the heat to exterior plates, by communicating while the piston travels the rest of the stroke. This mode of steam condensing may be considered as a compound of condensing with injection water and condensing against metal plates' surface; because this water column, when performed on plates, divisions plates, slips, and brass wire, has time to communicate its heat while the piston performs the whole stroke."

ORIGIN OF GLASS.

The precise period when the art of glass-making was first discovered, is unknown; but it is certain that the knowledge of the art is of the highest antiquity, having long preceded the Christian era. This fact is established by many circumstances, and among others, by that of glass beads and other ornaments having been found adorning the bodies of Egyptian mummies, which are known to have been upwards of 3000 years old. Glass is also mentioned by the Greek poet Aristophanes, 400 years before the birth of Christ.

The first manufactories of glass of which we have any account, were erected in Tyre, an ancient Phœnician city on the coast of Syria. The art afterwards extended to the towns of Sidon and Alexandria, which places also became famous for their glass ware. From Syria the art of glass-making found its way to Greece, and from thence to Rome, where a company of glass manufacturers established themselves in the reign of Tiberius. The seat of the art of glass-making in process of time changed from Rome to Venice, or rather to Murcano, a small village in the vicinity of that city. For many years the Venetian glass, in its various forms, supplied nearly the whole of Europe for that description of ware.

From Venice the art of glass-making found its way to France, where an attempt was made to rival the Venetians in the manufacture of mirrors in the year 1634; but subsequent attempts and improvements at length enabled the French speculators not only to rival, but excel, the Venetians; and about the end of the seventeenth century, they succeeded in casting plates of glass for mirrors, of a size which had been thought unattainable.

At what period the manufacture of glass was first introduced into England is uncertain, but there is reason to believe that glass was made so early as the beginning of the fifteenth century. This appears from a contract, dated 1439, between John Prudde, of Westminster, glazier, and the Countess of Warwick, to embellish a magnificent tomb for her husband, in which Prudde is bound to use "no glass of England, but glass from beyond the seas."

Glass windows, according to Bede, were first introduced into England in the year 647, to glaze the church and monastery of Weremouth. Another authority attributes the introduction of this luxury to Bishop Winifred, who died in 711; it seems, therefore, probable, that glass windows were first introduced into England about the end of the seventh or beginning of the eighth centuries. Previous to this, and for many centuries afterwards, the use of window glass was confined entirely to buildings appropriated to religious purposes, until the close of the twelfth century, when glass windows became common in England. In 1557, the finer sort of window glass was manufactured at Crutched Friars, in London. The first flint glass was manufactured at Savoy House, in the Strand, and the first plate-glass for mirrors, &c., was made at Lambeth in 1673, by Venetian workmen, brought over by the Duke of Buckingham. The date of the introduction of the art of glass-making into Scotland took place in the reign of James VI., in the year 1610.

At what period the art of simply staining, tinging, or colouring glass, was first discovered, is uncertain, but tradition says, that it was discovered by an Egyptian king; it is, however, certain, that the art was known in Egypt several thousand years since, the most beautiful imitations in glass of precious stones of all colours manufactured there, and of this antiquity, being still extant.

The first painted glass done in England was in the time of King John. Previous to this period, all glass of this kind was imported from Italy; but as early as the reign of Henry III., England boasted of several eminent artists in glass-painting. —*Glazier's Manual.*

THE CHEMIST.

ON ALKALIES.

(Continued from page 98.)

Sanguinaria (Vegeto).—This alkali exists in the blood-wort, and was first separated by Dana. It is prepared as follows:—Alcohol is first digested on the root, which must be finely powdered. This tincture is filtered and mixed with ammonia; then poured into water; a precipitate falls, which yields the alkali to hot alcohol;

this, filtered through animal charcoal and evaporated, leaves the pure sanguinaria. It is white; soluble in ether and alcohol, but not in water. It combines with acids, forming salts of a red colour.

Soda (Vegeto).—This alkali is of the most extensive importance in the manufacture of soap and glass: it is greatly used in bleaching and in chemical researches. For commercial purposes, it is chiefly obtained by the decomposition of common salt by sulphuric acid. The following is the theory of this decomposition: Common salt (i. e. table salt) or chloride of sodium, is a compound of chlorine and sodium. Sulphuric acid of commerce is a compound of *dry* sulphuric and water: when the acid is poured on the salt, its water is decomposed, the hydrogen of which unites with the chlorine of the salt, forming hydrochloric acid, which is evolved; while its oxygen unites with the sodium, forming soda, which combines with the free sulphuric acid, forming sulphate of soda. The annexed diagram will illustrate this more fully; the original substances are printed in SMALL CAPITALS; the results of the decomposition in *italics* outside the braces, while their composition are in common type within the braces.

TABLE SALT.

Sulphate of Soda	*Soda*	Sodium	Chlorine	*Hydrochloric Acid.*
		Oxygen	Hydrogen	

SULPHURIC ACID + WATER.

The sulphate is converted into a rough carbonate, by igniting it in a reverberatory furnace with lime and coal-dust. The best proportions, according to Dr. Ure are sulphate of soda, 100 parts; carbonate of lime (chalk or limestone), from 110 to 120, according to purity; pit coal, 50 parts: the black ball produced by this process must then be broken into fragments and thrown into large iron cisterns, furnished with false bottoms of wooden spars. When the cisterns are nearly full of these lumps, water must be pumped in upon them, until they are all covered. After a few days, the lixiviation is effected, and the ley is drawn off either by a siphon or by a plug-hole at the bottom of the cistern, and run into evaporating pans. Another method of manufacturing crude soda is, by burning seaweeds into what is termed kelp or soda-ash, from which the soda is procured by lixiviation in the same manner as potassa. Pure soda for chemical purposes must be obtained from its carbonate; the same formula will answer for this alkali, as given under potassa. Caustic soda is white, of a fibrous texture; corrosive upon animal matter. Its specific gravity is 1.536.

It is curious that both soda and potassa combine with *transparent* olive oil, and produce *opaque* soap, while they unite with *opaque* sand, and form *transparent* glass. Soda may be distinguished from potassa by not forming a precipitate either with tartaric acid or chloride of platinum, which the latter never fails to do. It is also distinguished by giving a yellow flame to burning alcohol; holding it, or any of its salts, in solution. Soda was decomposed with the same phenomena as potassa by Sir H. Davy. According to his analysis, it is composed of

Sodium	74.6
Oxygen	25.4
	100.0

Anhydrous soda can only be obtained by burning sodium in dry oxygen gas.

Solania (Vegeto) is an alkali that was discovered by M. Desfosses, in the berries of the common nightshade. Several able chemists have treated them according to his directions, but have only obtained a small quantity of phosphate of lime, without any solania whatever; it has, however, been obtained from the filtered juice of the berries (in which it exists in combination with malic acid), by treating it with ammonia, which causes a grey precipitate. This, collected on a filter, washed with water, treated with alcohol, then filtered through animal charcoal, yields by evaporation pure solania. When pure, it is a pearly-white opaque powder; has no smell; its taste is slightly bitter, which becomes more sensible by solution in acids, more particularly the acetic. It is insoluble in cold water, and hot only takes up 1.8000 parts of its weight. Its alkaline characters are but feebly manifested by its action on tumeric; it, however, restores turnsol that has been reddened by acids. It is composed of

Carbon	62
Hydrogen	8.9
Nitrogen	1.6
Oxygen	27.5
	100.0

G. W. S. Piesse.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, Sept. 2, Quarterly General Meeting. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street. — Thursday, Sept. 3, D. Mallock, M. A., on Astronomy and Physical Geography. At half-past eight.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, Sept. 2, Mr. Cavalier, on the Solar System physically considered. At eight o'clock.

TO CORRESPONDENTS.

W. C.—*The character formerly employed to abreviate the word* and, *was composed of the letters E and T. It has since been altered into &; but in modern printing it is seldom used. It is called by printers the* short and; *and some schoolmasters, and more especially schoolmistresses, teach children to call it* Hamper's and; *this appellation has not, however, obtained much beyond the above-named authorities.*

W. E.—*The number of musical sounds, considering only the distinction of grave and acute, is unlimited. Euler is of opinion, that no sound making more than 7520 vibrations, or less than thirty in a second, is distinguishable to the human ear. According to this doctrine, the limits of appreciable sounds, from grave to acute, is an interval of eight octaves; but as nearly the whole of this interval is practically employed in modern music, it is probable that the real limits of appreciable sounds are much more extended. An ordinary ear can easily distinguish 1000 sounds in progression from grave to acute, and a good critical ear an incomparably greater number. No more than three sounds and their reduplicates, can be combined together in perfect concord; they are the tonic, mediant, and dominant. The chords of the adjacent keys—viz. the subdominant and dominant, are composed of the same* relative *sounds as the tonic harmony, but formed upon different fundamentals. The most perfect harmony possible is composed as follows:—Tonic, 8th, 12th, 15th, 17th, and 19th; that is (in the key of C), C, c, g, $\bar{c}$, $\bar{e}$, $\bar{g}$, forming in the bass the octave; and, ascending, the fifth, fourth, major third, and minor third. Harmony is the periodic coincidence of two or more series of vibrations; in the foregoing example, during one vibration of the bass (C), the other sounds make respectively 2, 3, 4, 5, and 6 vibrations. Hence is deduced a corollary, which should never be lost sight of in symphonic composition—viz. that the greater intervals, octaves, and fifths, should be employed in the bass, and the lesser intervals reserved for the upper parts, whenever the chief design, and intended effect of the composition will permit it. The fifth, major third, and minor third, with their inversions and reduplicates, are the only concords in music. In the organ, piano-forte, and other imperfect instruments, there are, indeed, only twelve sounds comprised in an octave; but the correct execution of the various modulations which occur, especially in modern music, requires a great many more. Our correspondent states, that he has been informed by a* teacher of music, *that there are no more than seven sounds! The seven notes which form the major diatonic scale, are derived from the chords of the tonic, subdominant, and dominant;—ut, mi, sol, from the tonic; fa and la from the subdominant; and si and re from the dominant. In the minor mode, one more sound, at least, is required to form the leading note, which is always a major third to the dominant. So far from this being the whole number of sounds recognised in music; it is, in fact, the least possible number with which a complete scale can be formed, and will admit of no complete modulation whatever, without the introduction of other sounds. The peculiar voice or* timbre *which distinguishes different sounds, is occasioned by the confluence of extraneous vibrations with the principal ones which decide the tone. The great bell of St. Paul's produces a perfect chord, the fundamental note of which is B flat, and the predominant sounds, B flat and F its dominant. Vibrating strings are always accompanied with the harmonic vibrations of their aliquot parts, which impart a peculiar sweetness to their sounds; there are also many circumstances, independent of the vibrations of the sonorous body itself, which materially affect the quality of its sound; the same string, for instance, will produce different sounds when placed on different instruments, owing to the auxiliary vibrations of the instrument itself. Some sounds are so complicated, that no place can be assigned to them on the scale, as grave or acute; such is the falling of rain, the rustling of trees, when agitated by wind, or a great number of strings tuned to different notes, and simultaneously struck. These are more properly called* noises.

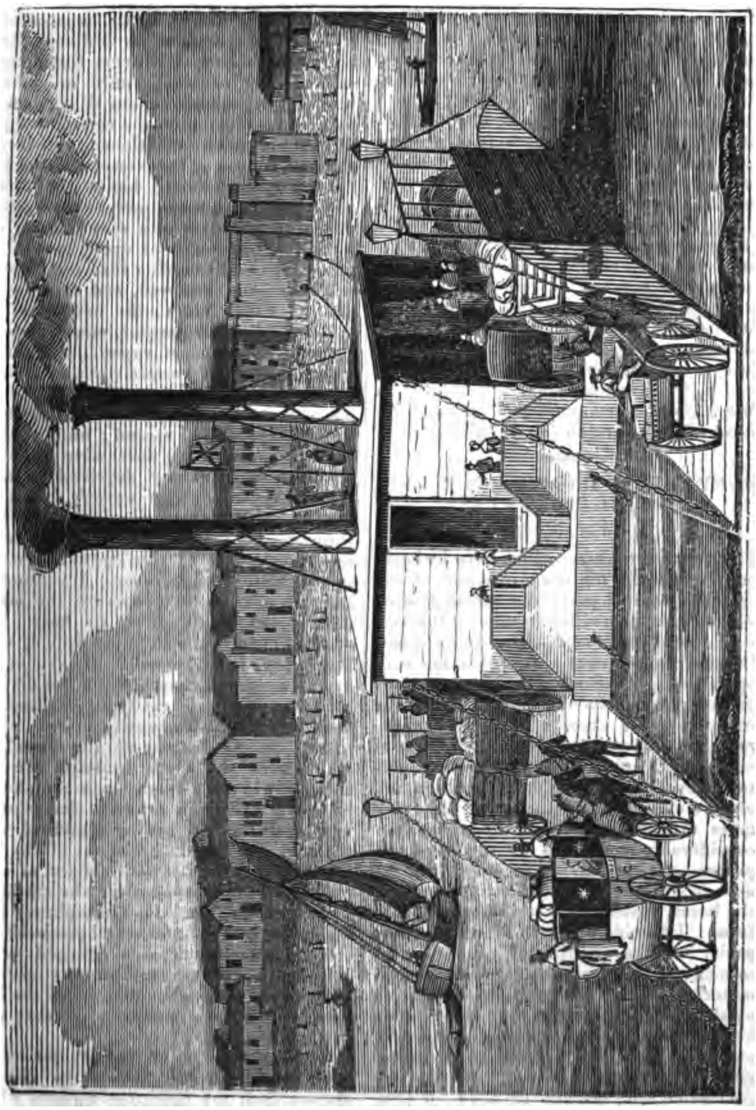
Viator.—*We lament an accident on a railway, as we lament an accident by fire, or at sea, or by any of the perils impending on humanity; but it should be borne in mind, that every accident that happens on a railway, renders railway travelling more secure, inasmuch as it directs attention to the defective construction or improper management which caused it, and thus leads to the application of a remedy to prevent its recurrence.*

London: Printed at "The City Press," 1, Long Lane, Aldersgate, by Doudney & Scrymgour (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. Berger, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 108, NEW SERIES. | SATURDAY, SEPT. 5, 1840. PRICE ONE PENNY. | No. 229, OLD SERIES.



THE PORTSMOUTH AND GOSPORT FLOATING BRIDGE.

City Press, 1, Long Lane: Doudney and Scrymgour.

THE FLOATING BRIDGE.

(See Engraving, front page.)

We this week furnish our readers with a sketch of the new Floating Bridge plying between Portsmouth and Gosport. The facility which it offers for crossing the harbour to vehicles of every description, has been attended with considerable benefit to the latter town. A bridge of a similar kind plies upon the Itchen—a small river breaking off from the Southampton water; but this bridge is very inferior to the other, both in size and speed. We believe that on the former, as many as 500 persons have passed over at once, besides vehicles of various kinds. The passage of about a mile and a half occupies, we suppose, about eight or ten minutes, and is performed with the greatest safety and accommodation. This bridge is worked by means of two steam-engines of considerable power, and runs upon chains, as shown in the engraving, to prevent its being drifted out of its track by the tide, which ebbs and flows at this part of the harbour with considerable power. We are informed that another bridge is constructing of a similar kind, which, when in operation, will start from either shore every quarter of an hour, instead of, as at present, each half-hour.

ROEDERER'S PROCESS FOR PREPARING ACETATES.

(Abstract of Specification.)

The various processes which have hitherto been employed for the formation of the acetates, and in particular the acetate or sugar of lead, consisted in mixing the base with liquid acetic acid, either in a concentrated or weak state. But this mode of operating is productive of many serious disadvantages, among which may be mentioned, the expense of fuel, of apparatus, of labour, and of time, the loss of acid, and the difficulty of producing acetates capable of perfect crystallization and of pure quality. Most of these disadvantages are obviated, and the remainder considerably moderated by my improved process, which consists in employing the acid in the state of vapour, to act upon the bases, instead of using it in the liquid form. I provide a vessel of adequate capacity for the quantity of acetate I wish to make at once, and constructed of such material as will not be readily destroyed by the acid. The top of this vessel I close hermetically by a cover, fastened down by any convenient means; and in the lower part of the vessel I place either a minutely perforated false bottom, or a coiled tube of several convolutions, minutely perforated, to permit vapour to pass through freely. To prevent the loss of acid, I also place, at different degrees of elevation, several perforated diaphragms, similar to the false bottom just mentioned, on each of which I spread a layer of litharge (if I am making acetate or sugar of lead, or a layer of other proper base, according to the acetate required); after which the cover of the vessel is to be accurately closed. By means of an ordinary distillatory apparatus, I convert liquid acetic acid (strong or weak, pure or impure) into vapour, which vapour I conduct by means of a pipe, into the convoluted perforated pipe before mentioned, or between the real bottom of the vessel and the perforated false bottom; hence the vapour passing through the numerous perforations of the false bottom and diaphragms, diffuses itself throughout every part of the vessel, its acid entering into combination with the base employed, and forming the acetate, which falls to the bottom of the vessel, and, in its descent, meets with the ascending streams of vapour, the acid of which renders it perfectly neuter; meanwhile, the more aqueous parts of the vapour become liberated, and, maintaining their temperature, ascend; and, in their passage through the successive layers of the base, are thereby deprived of their remaining acid. The vapour, thus reduced to simple steam, is allowed to escape through one or more pipes, at the top of the vessel; and as this steam still maintains a boiling temperature, I conduct it through a worm, to evaporate the acetas or the mother liquor by its heat. The distillation of the acid is continued, until the acetate in the vessel is arrived at the proper degree of concentration for crystallization; which is easily ascertained, by examining a small quantity drawn off by a cock at the bottom of the vessel, by which cock the whole contents are discharged when the operation is completed.

As the operation draws to its close by nearly all the base having combined with the acid, the vapour issues out of the vessel charged with a certain portion of acid; and, in order that no loss may be sustained by its escape into the atmosphere, it is conducted into another vessel prepared like the first mentioned, but charged superabundantly with the base, to take up every particle of the acid issuing out of the first vessel, until the operation in that first vessel is ended.

The great saving of fuel effected by my process, is evident from these circumstances, that my operation finishes where

the ordinary one begins, and that the mother liquor is evaporated by the latent heat of the aqueous vapour before it is discharged. The apparatus is extremely simple and cheap; being also self-acting, much labour is avoided by it; and, finally, as the temperature of the solution or the acetate can never exceed that of the vapour, the crystalline product is of finer quality than ordinary.

DESCRIPTION OF ELECTROTYPE.

To the Editor of the Mechanic and Chemist.

SIR,—Owing to the various queries of your correspondents as to the method of making the electrotype apparatus, I am induced to lay before you an account of this interesting discovery, as explained by Mr. Spencer, of Liverpool, before the Liverpool Society.

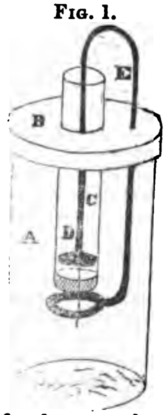
F. WEISS.

Liverpool.

The process consists in precipitating copper from its solution upon medals, moulds, &c., so as to produce exact fac-similes; every line being as delicate and sharp as the original, and so easy to manufacture, that it is impossible to err in the process, or to fail in its fulfilment.

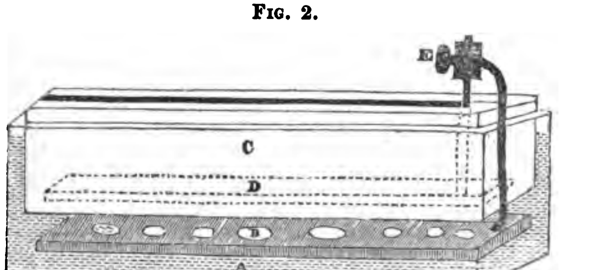
" My first essay was a piece of thin copper plate, having about four inches of superficies, with an equal-sized piece of zinc, connected together with a piece of copper wire. I gave the copper a coating of soft cement, consisting of bees' wax, resin, and a red earth (Indian or Calcutta red). The plate received its coating while hot. On cooling, I scratched the initials of my own name rudely on the plate, taking special care that the cement was quite removed from the scratches, that the copper might be thoroughly exposed. This was put in action in a cylindrical glass vessel, about half filled with a saturated solution of sulphate of copper. I then took a common gas-glass, similar to that used to envelope an Argand burner, and filled one end of it with plaster of Paris, to the depth of three-quarters of an inch. In this I put some water, adding a few crystals of sulphate of soda to excite action; the plaster of Paris serving as a partition to separate the fluids, but sufficiently porous to allow the electro chemical fluid to permeate its substance. I now bent the wire in such a form, that the zinc end of the arrangement should be in the saline solution, while the copper end should be in the cupreous one. The gas-glass, with the wire, was then placed in the vessel containing the sulphate of copper. It was then suffered to remain, and in a few hours I perceived that action had commenced, and that the portion of the copper, rendered bare by the scratches, was coated with the pure bright deposited metal, whilst all the surrounding portions were not at all acted on."

FIG. 1.



In order to illustrate the foregoing and following experiments figs. 1 and 2 are introduced. In fig. 1, A is a glass, or other vessel, holding about a pint; B is a wooden cover, fitted on to the top of it; C is the lamp glass, fixed in the middle of the cover, and furnished with the plaster-of-Paris bottom; D is a wire, having a piece of zinc at the bottom of it; E is a second wire passing through the wooden top, and bent below, where it has the plate of copper fastened to it. Fig. 2 is an apparatus

FIG. 2.



upon a larger but similar construction; A is a square glass vessel; B, a plate of copper holding several medals upon it, all of which are either united by soldering to the copper plate, or else united to it by a drop of quicksilver on the edge of the medal;

C is a box made of plaster of Paris, fitting into the glass box, A, but prevented touching the bottom of it, either by props underneath, or else protecting ledges at each end; D is the plate of zinc; E is the screw that binds together the two wires. By this simple apparatus, a number of objects may be made at once.

"*To Engrave in Relief on a Plate of Copper.*—Take a plate of copper, such as are in use among engravers; it is not essential that it should be highly polished. Have a piece of copper wire, neatly soldered to the back of it, and then give it a coating of the cement already mentioned. This is best done by heating the plates as well as the wax; or, to level the wax after it has had a coat, hold the back part of the plate over a charcoal fire or spirit lamp, taking care to hold it level; then write or draw the design on the wax with a black-lead pencil or point. The wax must now be cut through with a graver or steel point, taking especial care that the copper *is exposed on every line*. It must now be immersed in dilute nitric acid (aqua fortis), say three parts water to one acid; it will be at once seen whether it is strong enough, by the green colour of the solution, and the bubbles of nitrous gas eliminated. Let it remain long enough to allow the exposed lines on the plate to be slightly corroded, that the wax (which gets into the pores of the copper during the heating process) may be thoroughly got rid of. Practice will determine this better than any rules. The plate is now ready to be placed in the voltaic apparatus. After the voltaic copper has been deposited in the lines engraved in the wax, the surface of formation will be found to be rough, more or less, according to the quickness of the action. To remedy this, rub the surface with a piece of smooth flag or pumice-stone with water; then heat the plate and wash off the wax ground-work with spirits of turpentine and a brush. The plate is now ready to be printed from at a common press.

To deposit a solid Voltaic Plate, having the lines in Relief.—Take a plate of copper, lead, silver, or type-metal, of the required size, and engrave on it, to the depth requisite to print from when in relief. Contrary to ordinary engraving, the lines must be flat at the bottom, and as nearly as possible of the same depth; when so engraved, should the plate be copper or silver, heat it, and then apply a little bees' wax (what is termed virgin wax is preferable), mixed with a very small proportion of spirits of turpentine, and give the plate a coating of it. It may be laid on in a lump; and the heat of the plate should be sufficient to melt it. When on the eve of cooling, the plate should be wiped clean, and all the wax taken off, as sufficient will have entered the pores of the slate, to prevent the voltaic copper from adhering. Then solder a piece of copper wire. The plate must now receive a couple of coats of thick varnish on the back and edges (a preparation of shell-lac and spirit of wine does very well). I prefer, if the plate is large, to imbed it with plaster of Paris or Roman cement, in a box the size of the plate, allowing the wooden edge of the box to project just as much above the surface of the plate, as you wish the thickness of the voltaic one to be: care must be taken to keep the engraved surface of the plate clean. It is now ready to be placed in the apparatus to be deposited on. Should the plate be lead, or, what is still better, type-metal, the preparation of wax does not require to be given to the plate; as, when it deposited on to the given thickness, applying heat is sufficient to loosen them."

(*To be continued.*)

LAUNCH OF H.M.S. ST. GEORGE, 120 GUNS,

From the Dock-yard, Devonport, Aug. 27, 1840.

PRECISELY at half-past five o'clock on the above day, the last shore was removed —the "St. George"—that magnificent specimen of British art, received her name; and, amidst the cheers of myriads, the band playing "Rule Britannia," gracefully kissed the wave of that ocean on which we hope she will long remain a monument of England's glory. The space she had but just so nobly occupied, presented to the eye a densely-peopled amphitheatre, of such magnitude, as could not fail to produce strange feelings at the change that had so suddenly and almost imperceptibly occurred. The Royal Marine band was stationed near the platform, at the bow, and played some of the choicest national airs. We were much struck with the taste displayed in forming the admiral's booth, which was tastefully decorated with flags of different nations, surmounted by the flag of Lord Exmouth, under which he fought at Algiers, and which oft had "braved the battle and the breeze." The number of persons launched in the *St. George*, amounted to about 1500.

The *St. George* takes her place among first-rates of the first-class. She mounts

120 guns, and will have a complement of 820 men. Her dimensions, which have been furnished from good authority, are as follows:—

	Ft.	In.
Extreme length from figure-head to taffrail	247	0
Breadth extreme	55	3
Length of the gun-deck	205	11
Ditto of keel for tonnage	170	5
Height aft, from taffrail to keel	64	0
Ditto afore, from figure-head to keel	58	0
Length of lower deck	205	6
Breadth for tonnage	54	9
——— moulded	53	11
Depth of hold	23	2
Burden in tons, old measurement	2719—17·94	
Ditto, new measurement	2670	
Length of fore mast	118	0
Diameter of ditto	0	40
Length of main mast	127	0
Diameter of ditto	0	42
Length of mizen-mast	86	0
Diameter of ditto	0	26
Length of bowsprit	75	0
Diameter of ditto	0	40

FORCE AND CALIBRE.

Lower deck—Four guns to throw 8-inch shells, and two 32-pounders.

Middle deck—Two guns to throw 8-inch shells, and three 32-pounders.

Upper deck—Thirty-four 32-pounders.

Quarter-deck and forcastle—Six long 32-pounders; one 32 lb. carronade.

To build a ship of the magnitude of the *St. George*, will require nearly 6000 loads of timber; and allowing that each tree will, on an average, produce two loads, it would take about 3000 trees to furnish timber for such a ship. Now, it has been estimated, that thirty trees of full growth will cover an acre of ground; consequently, it will take 100 acres to produce sufficient timber for a ship of this class; and, as timber of large scantling is from eighty to a hundred years coming to its full growth, the quantity of land required for navy timber in this country, must be immense. This is a serious question, it being well known that there was an alarming scarcity of oak in this country in the time of war. Foreign timber is, therefore, introduced very extensively in ship-building.

The cost of building a similar ship to the *St. George*, has been computed as follows:

For labour alone	£15,643
Materials	77,878
Total cost	93,521

This will give 34*l.* 7*s.* 10*d.* per ton for building. The value of labour appears to be very nearly one-sixth of the whole; and the value of workmanship to materials about in the ratio of one to five. At the above rate of earnings, which allow about 5*l.* 15*s.* per ton for workmanship, it would take 200 men twelve months to build the ship.

It will scarcely be credited, perhaps, that the average durability of British men-of-war has been estimated to be only thirteen years! This we believe to be correct; so that the annual expense of keeping our fleets in efficient condition, may be said to amount to one-thirteenth part of the original cost of the whole. This is an important and striking fact.

The *St. George* was first ordered to be built in September, 1820; but it was not until the spring of 1827 that her keel was laid. In the course of the following year she was in frame, and was then left standing to season till 1832, when she was proceeded with by degrees, as the other works of the yard would admit.

Having been ordered to be built at a time when the late Sir Robert Seppings (then surveyor of the navy) was introducing extensive improvements in the practical department of ship-building, she was originally intended to be constructed throughout in strict conformity with his plans; but the alterations which have since taken place—more in detail, perhaps, than in principle—have led to corresponding changes in the works of the *St. George*. Hence it will be found that Sir R. Sepping's plans are adopted in many cases in a modified form. The original system of "oblique riders" and "trusses," for example, has not been introduced in the same manner, nor so extensively, *in the hold*, as originally intended; nevertheless, the diagonal principle has been maintained to a great extent in that part of the interior of the vessel. Diagonal decks have been altogether abolished; but the shelf-pieces have been retained, and the truss-pieces between the ports on the gun and the middle-decks strictly preserved. The stern has undergone the greatest change—a change for which the country is indebted to Mr. Roberts, the late master shipwright of this dock-yard, who suggested a plan for constructing sterns, at once elegant and effective.

The "quarter galleries" are not exactly as they were designed by Mr. Roberts, but have been lengthened a little in a fore-and-aft direction, and thereby improved, at the suggestion of Mr. Hawkes, the present master shipwright, under whose able

directions the ship has been finished, and by whom she was launched.

The figure-head is a full-length representation of St. George and the Dragon, but he has no horse—he is standing with his left foot on, and is slaying the dragon. The dimensions of the figure, measured in a vertical direction, are fourteen feet, and upwards of twenty feet if measured obliquely. It consumed about 200 cubic feet (or four loads) of fir timber (Quebec yellow pine), and cost, in addition to labour of "roughing it out," 100*l.* for the carving alone. It was designed and executed by Mr. Frederic Dickerson, of Plymouth, whose talent in this interesting department of the arts has procured for him a general order from the Lords Commissioners of the Admiralty, to execute all the carved work required for men-of-war at this dock-yard.

The *St. George* being of the same size and form as the *Caledonia*, the calculations which apply to the latter may be regarded as applicable to the former. The difference, if any, is unimportant. When launched, she will draw 15 ft. 1 inch forward, and 18 ft. 4 in. abaft.

The light displacement, or weight of the ship's hull, estimated from this draft of water, will be 2400 tons; the area of the corresponding water-section (or plane of flotation) will be 8440 feet; and the weight required to sink the vessel an inch, under those conditions, will be twenty tons. But, before the ship goes to sea, she will have to receive on board her armament, powder and shot, masts, yards, sails, rigging, anchors, cables, boats, water, stores, provisions, ballast, men, and their effects. These, it is calculated, will immerse her until she draws 24 ft. 8 in. forward, and 26 ft. 1 in. abaft. In this case, the weight of the ship and its contents will be 4784 tons, making an addition of 2384 tons beyond the weight of the hull alone. And it is a curious circumstance, that the weight of the ship should be nearly equal to the weight of its contents and equipment. The area of the load-water section, or plane of flotation, when equipped for sea, will be 10,012 superficial feet; and the weight required to sink the vessel one inch, will, under the circumstances, be nearly twenty-four tons. These are useful facts, because they show what weights should be taken on board to produce a certain immersion, or the weight which it may be necessary to take out of the ship, to lighten her to any desired draft of water.

As soon as convenient, she will be taken into dock for the purpose of removing the fixed fitments of the launch, and to be coppered. A first-rate will take 4000 sheets of copper (four feet long and fourteen inches broad), the weight of which is about twenty tons, and the value, including workmanship, something more than 2000*l.*

The quantity of sail capable of being spread upon spars of the dimensions in the table, is very great. It has been calculated to be 25,620 superficial feet! The surface of sail set upon the main-mast alone, has been estimated to be 10,273 superficial feet; the sails on the fore-mast, including the jib, 10,246 sup. feet; and those on the mizen-mast, 5101 sup. feet. By this it appears, that the sails set up on the fore-mast, including the jib, expose, as nearly as possible, as great an area to the action of the wind, as those on the main-mast; and that those belonging to the mizen-mast are equal in area, or nearly so, to one-fifth of the whole surface of sail.

The ballast which a ship of this description will take to sea, amounts to above 300 tons. She was launched with fifty tons in her hold; and if she be placed in ordinary, she will ultimately receive on board about twice the sea-going quantity, it being considered that ships at their moorings do not strain so much when partly laden.

THE ADVICE OF A PHILOSOPHER.

Take especial care that thou delight not in wine, for there never was any man that came to honour or preferment that loved it; for it transformeth a man into a beast, decayeth health, poisoneth the breath, destroyeth natural heat, brings a man's stomach to artificial heat, deformeth the face, rotteth the teeth, and, to conclude, maketh a man contemptible, soon old, and despised of all wise and worthy men; hated in thy servants, in thyself and companions; for it is a bewitching and infectious vice. A drunkard will never shake off the delight of beastliness; for the longer it possesses a man, the more he will delight in it, and the older he groweth, the more he will be subject to it; for it dulleth the spirits and destroyeth the body, as ivy doth the old tree; or as the worm that engendereth in the kernel of the nut. Take heed, therefore, that such a careless canker pass not thy youth, nor such a beastly infection thy old age; for then shall all thy life be but as the life of a beast, and after thy death thou shalt only leave a shameful infamy to thy posterity, who shall study to forget that such a one was their father. Anacharsis saith, the first draught

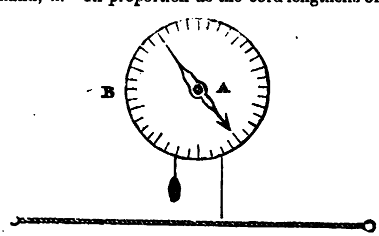
serveth for health, the second for pleasure, the third for shame, the fourth for madness; but in youth there is not so much as one draught permitted; for it putteth fire to fire; and, therefore, except thou desire to hasten thine end, take this for a general rule, that thou never add any artificial heat to thy body, by wine or spice, until thou find that time hath decayed thy natural heat; and the sooner thou beginnest to help nature, the sooner she will forsake thee, and trust altogether to art. Who have misfortunes, saith Solomon, who have sorrow and grief, who have trouble without fighting, stripes without cause, and faintness of eyes? Even they that sit at wine, and strain themselves to empty cups. Pliny saith, wine maketh the hand quivering, the eyes watery, the night unquiet, a stinking breath in the morning, and an utter forgetfulness of all things. Whoso loveth wine shall not be trusted of any man, for he cannot keep a secret. Wine maketh man not only a beast, but a madman; and if thou love it, thy own wife, thy children, and thy friends, will despise thee. In drink, men care not what they say, what offence they give, forget comeliness, commit disorders; and, to conclude, offend all virtuous and honest company, and God most of all, to whom we daily pray for health, and a life free from pain; and yet by drunkenness and gluttony (which is the drunkenness of feeding) we draw on, saith Hesiod, a swift, hasty, untimely, cruel, and an infamous old age. And St. Augustine describeth drunkenness in this manner:—"Drunkenness is a flattering devil, a sweet poison, a pleasant sin, which whosoever hath, hath not himself; which whosoever doth commit, doth not commit sin, but he himself is wholly sin." Innocentius saith, "What is filthier than a drunken man, to whom there is stink in the mouth, trembling in the body! which uttereth foolish things, and revealeth secret things; whose mind is alienate and face transformed? There is no secrecy where drunkenness rules; nay, what utter mischief doth it not design? Whom have not plentiful cups made eloquent and talking?"—*Sir Walter Raleigh.*

MISCELLANEA.

Animated Plants.—In No. 60, N S., of your Magazine, I perceived an article headed "Zoological Society," in which it is stated that Mr. Mackay had discovered an insect, the legs of which, after a certain time, take root; it being changed into a plant. That the seeds of certain plants might easily be mistaken for insects, is a thing not difficult to conceive, since we have an example in what has been called the *animated oat* of seeds, when wetted, acquiring a kind of locomotive power. The animated oat has two long awns, not very dissimilar to the legs of a grasshopper; when the water percolates these, they necessarily become distended, and the body of the seed is put into motion; by degrees it is turned over, and made even to skip; although not with quite the vivacity and force of a shrimp or a grasshopper, yet in a manner really surprising and amusing. I think the foregoing explanation accounts, in some measure, for the mistake (for mistake I must call it) of Mr. Mackay.

FELIX WEISS.

The Hygrometer.—The variations in Rutter's hygrometer would be much better seen, if the silken thread be brought up over a pulley, that carries at one of its extremities a light index or hand, A. In proportion as the cord lengthens or



shortens, it will cause the pulley to turn in one or the other direction, and, by a necessary consequence, the index turns likewise; the motion of which may be measured on the circumference of a graduated circle, B, about which the index performs its revolutions, as in the wheel barometer.

E. L.

Effects of Weather on the Animal System.—The human body, it is well known, is pervaded with that subtle fluid termed electricity. It operates on the animal economy as a direct stimulus; and by many physiologists it is believed that the electrical fluid is identical with the nervous energy; in other words, that the power of the nerves really consists in electricity, which, whether as a distinct fluid or not, pervades them. Therefore moist winds, coming in contact with bodies possessed of more electricity, will rob them of part of their electric fluid, until an equilibrium is effected between the earth and air. Now as the human body readily parts with and receives electricity, it will follow that it must afford a ready point for the transmission of this fluid by the surrounding atmosphere, and the symptoms of depression naturally ensue. This sufficiently explains the influence of every different kind of weather in exciting or depressing the nervous energy of the animal system in any season or climate.

Cure for Toothache.—At a meeting of the London Medical Society, Dr. Blake stated, "that he was able to cure the toothache (unless connected with rheumatism) by the following remedy:—Alum reduced to an impalpable powder, two drachms; nitrous spirit of ether, seven drachms. Mix and apply them to the tooth."—*Lancet.*

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, Sept. 10, W. Vesalius Pettigrew, M. D., M.R. C.S., on the Anatomy and Physiology of the Organ of Hearing. At half-past eight.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, Sept. 9, Lecture and Discussion:—Is Atmospheric Air a Chemical Compound?—Mr. Thomas. At eight o'clock.

QUERIES.

What kind of oil, &c., is it that is used for making both the black and yellow oil-cloth, and how prepared and used? J. W. S.

1. What is the best method of making sealing-wax? 2. What is the best method of making wafers? 3. A description of the process of polishing lenses? G. Thurlby.

How is the chromatic fire cloud produced, that has been exhibited with such success lately in the various institutions at Manchester, London, &c.? A. K.

The best receipt for preparing and gilding calf, roan, and other leathers? Josephus.

A receipt for cleaning kid gloves? A. C. R.

Having made the French polish according to the receipt in No. 118, Vol. III., and used it according to the directions inserted in the same Number, upon a square piece of wood as a pattern, and have put on as many as twenty coats of polish; and yet the middle of the piece of wood is as dull as ever, while all round the sides is a beautiful polish. I should like to know where I am wrong. Perhaps your correspondent "W. G. A. H.", who sent you the article headed "French Polish" in No. 101, will inform me of the whole process through the medium of your Magazine, and thereby greatly oblige

Experimental Mechanic.

ANSWERS TO QUERIES.

Indian Glue.—"H. Hill," of Cork, is informed that Indian glue is known by the name of *Vancouvre's cement*, and is used for the purpose he mentions.

Metal Healds.—Having seen in your publication of the "Mechanic and Chemist," a query, asking if the metal healds for weaving linen, woollen, cotton, silk, &c, are in use, or likely for answering; I, as the patentee, beg to inform your correspondent, that they are in use at different places in this town, and do answer well. If your correspondent should wish to try them, he may obtain them from me.

John Osbaldeston.

Blackburn.

[The insertion of the above has been delayed in the expectation of receiving some farther description of the invention from the patentee.—Ed.]

TO CORRESPONDENTS.

W. E. jun.—*Charcoal may be used for steam-engine models, but it would be inconvenient in a small close room.*

To cut gold and silver leaf into round pieces (or any other form), it is only necessary to use an ordinary stamp, and cut through the whole book. The intervening paper will prevent the metal from ruffling or tearing.

Iron work may be preserved by laquor, applied in the same manner as upon brass. If made with clear gums and coloured blue, the appearance is very handsome.

There is a substance about the consistence of size, which, when put upon shoes, &c., produces a durable, glossy black, without the application of friction. It is a valuable secret of the craft, and extensively employed for goods intended for exportation.

Description of Perkins's steam-gun in a future Number.

Multum in Parvo *will be noticed in our next.*

T. Hedgcock *proposes the following original query:—Why should a time-keeper, chronometer, or any piece of mechanism similarly made, not proceed perpetually, until its parts are worn out, when wound up, or partly so, if the key is secured, as it always proceeds while so winding and being so set in motion; why is this not considered the nearest approximation to perpetual motion? By its principle in mechanics, air-pumps, hydraulics, and loom power, or any vehicle or machinery, ship or vessel, might be propelled by the application of its power, and, in a time-keeper, its rate uniform.*

Thos. Hedgcock, Master R. N.

We trust there are but few of our readers who need a voice from the "City Press," to tell them that the motion of a machine cannot be perpetuated by arresting the power which is the source of that motion; but as the suggestion proceeds from a gentleman who is the author of an expensive work on astronomy, longitude, &c., we will briefly explain the fallacy of the notion. During the operation of winding up a chronometer or watch, the action of the main-spring is suspended; so that the machine would stop, and the required isochronal progression would be deranged, were it not for a contrivance which supplies a temporary power to maintain the motus during the short period of winding. This apparatus is called a going fusee, and can be shown and explained by any watchmaker. It is usually calculated to continue its action from one to two minutes, and when it is exhausted, all progressive motion must cease.

Erratum.—Page 136, col. 2, for "per steam 15s." read 15s. and 10s.

London: Printed at "The City Press," 1, Long Lane, Aldersgate, by Loudney & Scrymgour (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. Berger, Holywell Street. Strand; and may be had of all Booksellers and Newsmen in Town and Country.

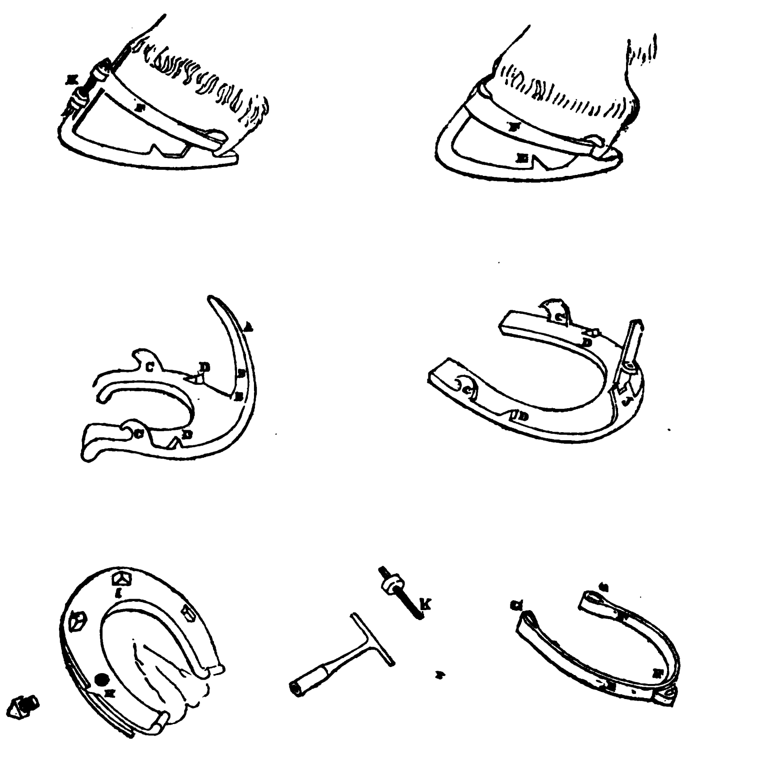
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 109, NEW SERIES. | SATURDAY, SEPT. 12, 1840. PRICE ONE PENNY. | No. 230, OLD SERIES.

DE GOURNAY'S PATENT HORSE-SHOES.



City Press, 1, Long Lane: Doudney and Scrymgour.

DE GOURNAY'S PATENT HORSE-SHOES.

(*Abstract of Specification.*)

This new invention of a horse-shoe, which may be made of any kind of metal, either simple or compound, forged or cast, the bridle or band of which may also be of leather, metal, or any other material, simple or compound, consists of an ordinary horse-shoe, of three specific parts only. First, the shoe, properly called the bridle or band, and a small point stop or catch, called in French, "*talus*," which enters the wall of the hoof. This shoe is an ordinary shoe, furnished with one or two clips or crotchets, A, drawn out from the mass, or soldered, and situated on the fore-part or toe at the extreme border of the shoe. The shoe may have one or two roughs or teeth, B, in the interior.

Two ears or stays, C, drawn out from the solid or soldered. The branches of the shoe are pierced for the talus, D, which are rivetted in, placed in an inclined direction of a form somewhat triangular, and may be in number from two to eight; these talus enter the wall of the hoof, in a small notch, which is cut for the purpose.

The ears or stays serve to receive the extremities of the band or bridle, F. This band or fillet may be made as before described, of different material, but is mostly of iron: it has the form of a circular arch, and represents on the hoof a sort of V. It is made in such a manner, that the ends are turned over and rivetted, forming a sort of loop, G, at the end, in which is placed the ears or stays; it then passes over the crotchet or clip, of which the extremity is curved and rivetted.

For winter, the shoes are pierced (H) for screws, I, which are placed and displaced at pleasure, and made of iron or steel. Cogs may also be placed and removed in the same manner.

In case of disease or defect, the crotchet or clip has a hinge, J, which communicates with the band by means of screws, K, which work upwards. This mode prevents the necessity of using the hammer on the hoof, and facilitates the stepping of the horse. It preserves the hoof in a state of cleanliness, which is very desirable during dressing. This last system may be applied equally to young horses and race horses, which are frequently shod and unshod.

DESCRIPTION OF ELECTROTYPE.

(*Continued from page* 148.)

"*To procure Fac-similes of Medals, &c.*—This may be done by two different methods; the one, by depositing a mould of the voltaic metal on the face of the metal (having first heated it and applied wax), and then depositing the metal, by a subsequent operation, in the mould so formed. But the more ready way is to take two pieces of melted sheet-lead (cast-lead not being equally soft), having surfaces perfectly clean and free from indentation. Put the medal between the two pieces of lead, subjecting the whole to pressure in a screw press; a complete mould of both sides is formed in the lead, showing the most delicate lines perfect, in reverse. Twenty, or even a hundred of these may be so formed on one sheet of lead, and are deposited by the voltaic process with equal or greater facility; as the more extensive the apparatus, the more regularly and expeditiously does the operation proceed. Those portions of the surface of the lead where the moulds do not occur, may be varnished, to neutralize the voltaic action; or, a whole sheet of copper being deposited, the voltaic medals may afterwards be cut out. A piece of wire must now be soldered neatly to the back of the leaden plate; it is then ready to be put in action.

A Voltaic Impression from a Plaster or Clay Model.—I took two models of an ornament, one made of clay and the other of plaster of Paris, soaked them for some time in linseed oil, took them out, and suffered them to dry; first getting the oil clean off the surface. When dry, I gave them a thin coat of mastic varnish. When the varnish was as nearly dry as possible, but not thoroughly so, I sprinkled some bronze powder on that portion I wished to make a mould of. This powder is principally composed of mercury and sulphur. I had, however, a complete metallic coating on the surface of my model, by which I was enabled to deposit a surface of copper on it, by the voltaic method I have already described. I have also gilt the surface of a clay model with gold leaf, and have been successful in depositing the copper on its surface. When the plaster or clay ornament is gilt with gold leaf or bronzed, a copper wire should be attached to it, by running through from the back, until the point appears above the front surface, or level with it, will be sufficient. The other end must then be attached to the binding screw connecting it with the zinc, in all respects similar to any of the foregoing methods.

To obtain any Number of Copies from an already Engraved Copper Plate.—A copper plate may be taken engraved in the common manner, the lines being *intaglio.* Procure an equal-sized piece of sheet-lead, lay in on the engraved side of the plate, and put both under a very powerful press; when taken out, the lead will have every line in relief that had been sunk in the copper. A wood engraving may be operated on in like manner; as lead, being pressed into it, will not injure it. A wire may now be soldered in the lead, then bed it in a box, and put into the whole voltaic apparatus, when a copper plate, being an exact fac-simile of the original, will be formed. In this process, care must be taken that the lead is clean and bright as it comes from the roller in the nulling process, and, consequently, free from any oxidation, which it soon acquires if exposed to the atmosphere. It should be put in action as soon as possible after being taken out of the press.

To Copy a Wood Engraving.—I may premise that, but for the plasticity and perfectly unelastic property of lead, the discovery would be of but comparatively small value. Plumbers, who have handled the substance for the greater portion of their lives, are astonished to find it so susceptible of pressure; on the contrary, wood engravers did not, until now, imagine their blocks would stand the pressure of a screw press on a lead surface without injury; but such is the fact in both instances. In the manner in which boxwood is used for wood engravings, being horizontal sections, it will sustain a pressure of 8000 lbs. without injury, provided the pressure is perfectly perpendicular. The wood engraving being given, take a piece of sheet-lead the requisite size; let its superficies be about one-eighth of an inch larger all round than that of the wooden block. The lead must now be planed with a common plane, just as a piece of soft wood. The tool termed by the joiner the try-plane does best. A clear bright surface is thus obtained, such as I have not been able to get by any other means. The engraved surface of the wood must now be laid on the planed surface of the lead, and both put carefully in the press. Should the engraving have more than two inches of superficies, a copying press is not powerful enough. Whatever press is used, the subject to be copied must be cautiously laid in the centre of the pressure, as a very slight lateral force will, in some degree, injure the process. The lead to be impressed upon must rest upon the iron plate of the press, as must the back part of the wood engraving; the pressure to be applied regularly, and not, as in some cases, with a jerk. When the pressure is deemed complete, they may be taken out: and if, on examination, the lead is not found to be completely up, the wood engraving may be neatly relaid on the lead, and again submitted to the press, using the same precaution as before. When the lead is taken out, a wire should be soldered to it immediately, and put into the apparatus without loss of time, as the less it is subjected to the action of the atmosphere the better. Care should be also taken not to touch the surface with the fingers. In the pamphlet, I stated the length of time usually taken to deposit the required thickness of metal. I have been since able to abridge that period three or four-fold, as I keep the solutions at a temperature of from 120° to 180° Fahrenheit. It has been suggested to me by Mr. Crosse, of Broomfield, to keep the solutions boiling, which still farther increases the rapidity of the deposition. Contrary to the general chemical analogy, the deposited metal is of a much superior quality to that deposited by the very slow action of a common temperature. At the time, it must be borne in mind, that if the process is quickened by strengthening the solution in the positive cell by the addition of an acid, the metal deposited in the opposite one is of a very inferior quality; so much so, as to be totally unfit for any practical purpose. Under these circumstances, the deoxidating process is not complete, the deposit being a reddish-brown protoxide of copper; this last, if let remain for a few days longer, undergoes a still farther change; it then becomes a black oxide of copper, such as may be used for organic analysis; and were I to pursue this branch of chemistry, I should never resort to any other method for obtaining it. The above process will apply to copying engraved copper plates or medallions. I have also been able to obtain impressions from wood engraving by the following method:—Take a piece of tinfoil, the size, or thereabouts, of the engraving; place it on the engraved surface; after this, place a piece of sheet India-rubber, and put the whole in a press; on taking out of which, it will be found the tin is thoroughly impressed into the lines of the wood. A coating of plaster of Paris must now be laid on the tin to about half-an-inch in thickness; when set, the whole may be taken off the wooden block. It will be found that the tin adheres to the plaster, and leaves the face of the engraving. The tin surface may now be deposited to any required

thickness. The above was tried on a coarse wood engraving. I am unable to say how it might answer for a fine one."

FELIX WEISS.

(*To be continued.*)

LIFE ASSURANCE.

NO. VIII.

(Concluded from p. 134.)

IT cannot be expected that perfection exists in a large degree, where the work of experience has been comparatively small; indeed, it is a general opinion, that there are but few cases where perfection can exist at all. However, in reference to the subject of Life Assurance, we may rest satisfied the time is fast approaching, when it will be far better understood than it is at present; and when, we trust, those defects which we have now had occasion to notice in some parts of the system, will be wholly removed.

We shall not make it our business at present, to pass any farther encomium upon Mutual Societies, but leave them on the premises they now occupy, well convinced of their future success. But we have a feature to notice, which stands very prominent in the character of the last two societies we placed on our list, which we shall do without farther commendations on either. "The National Provident" was established in 1835, and the "Productive" in the present year. In both these societies there are offered some high advantages to the middling classes, which afford a great protection to their respective members; namely these: that those societies are empowered, under certain Acts of Parliament, that give them severally a wide scope of privileges, which are to be found enumerated in either of their prospectuses; and, besides this, the power to invest their funds at the National Debt Office, with a total exemption from all stamp duties whatsoever.

But we return for a moment, to reflect seriously upon the system of giving commissions, as practised by several societies, to which subject we made some allusion in the last chapter. It will not be supposed, surely, that we object to a suitable remuneration to such as bring assurers to an office? No such thing, we have only to condemn, in very forcible terms, the practice, which we hope farther to acquaint the reader with. Before the plan was adopted by societies of giving commissions generally, an excellent writer made the following remark :—"Many of the public companies who do not make any return of the profits to the assured, allow a liberal premium (generally five per cent. on the payment made) to any person who will procure an assurance to be effected at their office; and this commission is also allowed to any person who makes the annual payment, provided it be not the party himself!" * But, had the above writer been living in the present day, he would have seen much more to censure than there appears in his remark; for not only is the commission given by offices that do divide their profits, as well as those who "make no return," but there are competitors in the trade, whose object is to obtain a greater number of assurers, although it be done by fraudulent means. We will suppose a case of a solicitor, whose clients generally reside in the country; it is in many instances the case (some of them wishing to assure), that he receives instructions to assure certain lives at the office he thinks most proper to select; and, for the trouble of doing so, of course is paid his fee. Now the solicitor is constantly seeing prospectuses, which intimate that "the usual commission is allowed to solicitors," &c.; and he naturally expects, on bringing assurers, to receive the said commission, and this is well so far as it goes; but just reflect a moment, reader, upon the practice of such persons taking lives to assure in offices which allow the greatest premium—although, we trust, there are few base enough to do so—yet consider how wantonly that trust has been betrayed, which persons usually place in their legal advisers, when in the important matter of assuring for a family provision, their premiums are paid at an office possessing no claims to merit—for we hold they are such—merely for the sake of obtaining on the part of their legal adviser, some five or ten per cent. profit on such transaction! And, indeed, we feel ashamed to add that, in some cases, offices *privately* allow something more than this, upon every payment that passes through a solicitor's hands, amounting annually to a very considerable sum.

The means continually resorted to, to win solicitors and others over to this system of agency, we will not attempt to discover; but we think it is a very clear illustration of the saying, that "were there no receivers of stolen goods, there would be no thieves." It is but in justice to many societies to say, they have no hand in deceptions of this sort; and it is only those who are so assiduous in their advertisements

* Baily on Life Assurance, Vol. II., p. 507.

and other means of making themselves known, who are guilty of a growing evil we would fain crush in the bud.

In conclusion, we cannot refrain from inviting the public to a general scrutiny of the matter of Life Assurance; it is a subject of so great importance, that it cannot be too widely diffused; and we hail the day when every paper and periodical will have a column devoted to the investigation of a principle sound in its doctrine, and which, therefore, must be beneficial in its practice. True, we are advocates for no wild speculations, which are the only stimulants which gave rise to some of our societies; but we see enough in the world of knowledge daily to prove to us that, even on this subject, there will shortly be much of the ignorance removed that at present exists; and fathers and heads of families will embrace with cordial approval, a plan of relieving their affectionate partners in widowhood, and of protecting their fond and helpless little ones, when left orphans and desolate.

SIGMA.

FARTHER PARTICULARS OF THE PORTSMOUTH AND GOSPORT FLOATING BRIDGE.

(From a Correspondent.)

THE floating bridge is seventy feet long, sixty feet wide, and draws three feet water. It has two cabins, which, together with seats at the side of the cabins, would shelter about 150 people. She is capable of carrying 500 persons and six carriages, with a pair of horses each, or a proportionate number of larger or smaller carriages. Two chains, the links of which are of iron thirteen-eighths inches thick, are stretched across the harbour, being each 2200 feet in length. At both ends these chains are joined to others, which pass over rollers into a shaft twenty-four feet deep; to the end of each, a weight of about five tons is attached, which rises and falls in the shaft, according to the strain on the chains, and prevents the danger of their breaking, as they thus yield to the force of the wind and sea coming into the harbour. These chains pass in at one end of the bridge and out at the other, through grooves, with sheeves above and below, to keep them at a certain angle in passing over large iron wheels of twelve feet diameter. In the centre of the vessel, on each side of the steam-engine, the edge of these wheels is adapted to the links of the chain, which take a firm hold; and, as the engines move the wheels, the chain passes, and the bridge is thus propelled. The chains are raised from the bottom as the bridge passes, and descend again at a short distance from it; so that vessels pass in and out of the harbour, without being interfered with by these chains. The engines used are two of twenty-five horse power each. The advantages to the neighbourhood are very great, there being a considerable population on each side of the harbour, and very great intercourse with Southampton, particularly since the completion of the railroad to London. The distance round the head of the harbour is fifteen miles. Persons on foot might, of course, go in boats, but there was much difficulty in conveying carriages and horses over before this bridge was established; but now they pass over with as much ease as if they were going on the high road.

About 1500 persons and 100 carriages of various sorts, pass daily over on this bridge. The expense is about 5*l.* daily, without allowing for wear and tear, or interest of capital. The charge for a carriage and pair is 1*s.* 6*d.*; for a single person, 1*d.*; in the best cabin, 3*d.*

Another bridge is in preparation, with engines of increased power, to be in reserve in case of any accident, or the necessity of repairs, so that there may not be any interruption to the intercourse. The bridge is about seven minutes in crossing the harbour, and starts every quarter of an hour.

THE CHEMIST.

ON ALKALIES.

(Continued from page 143.)

STRONTIA (Earthy.)—This alkali was first discovered about 1787, in a mineral brought from the lead mines of Strontian, in Argyleshire, whence its name. In these mines it occurs in a crystalline state as a carbonate. It is found as a sulphate abundantly near Bristol, and sometimes crystallized. In order to obtain this alkali in a state of purity, the native carbonate may be treated in the same manner as that I have described for obtaining pure baryta.* Strontia is a greyish-white powder, infusible in the furnace. Specific gravity rather under baryta. It has a sharp burning taste, but not so corrosive as baryta, though more so than lime. It becomes hot when moistened with water, and slakes into a pulverulent hydrate. It is soluble in 150 parts of water. It is

* Baryta, page 234, Vol. V.

distinguished from baryta, by causing a precipitate with iodate of soda and fluosilicic acid; and by its soluble salts giving a red tinge to flame. The only preparation of strontia used in the arts, is the nitrate, which is mixed with the chlorate of potassa, sulphur, and charcoal, for forming the composition of those brilliant red fires, so much admired in theatrical conflagrations. Strontia, like all the other earthy alkalies, was proved by Sir H. Davy to be the oxide of a metal, which he called strontium. Strontia, according to his analysis, consists of

Oxygen	86
Strontium	14
	100

Strychnia (Vegeto.)—This alkaline base was discovered by MM. Pelletier and Caventon. It is the active principle of those poisonous seeds, "The St. Ignatius bean." Nux vomica owes its violent action on animals to its containing this alkali. It is best procured from the St. Ignatius bean, for which purpose these seeds are to be reduced into powder by a rasp, and digested in ether, by which it is freed from a thick oily substance; this being withdrawn, the mass is to be treated with alcohol, this solution is to be filtered and then evaporated, when it leaves a brownish yellow substance; this is to be dissolved in water, and treated with a solution of potassa; a precipitate falls, which, when washed with cold water, is white, crystalline, and extremely bitter. It is strychnine nearly pure. One of the principal properties of this alkali is, that when introduced into the stomach, it acts with frightful energy, causing lock-jaw immediately. Half-a-grain blown into the throat of a rabbit, proves fatal in five minutes. It is inodorous; is soluble in alcohol, but not in cold water; boiling water takes up two thousand five hundredth part. Its taste is so powerful, that a solution containing the six hundredth thousandth part, possesses it in a marked degree. In combination with acids, it forms crystallizable salts, which are colourless. By the analysis of Dr. Liebig, it is composed of

Carbon	77.0
Hydrogen	6.8
Oxygen	10.2
Nitrogen	6.0
	100.0

SEPTIMUS PIESSE.

A DANGEROUS DISCOVERY.

To the Editor of the Mechanic and Chemist.

SIR,—Some weeks ago I perceived in a Manchester paper, a reference made to a composition prepared in France, by which letters may be destroyed by the writer unknown to the receiver.

It appears, from what could be gathered from the paper alluded to, that the writer, after finishing his letter, washes it over with the preparation, which causes the paper to fade or moulder away in the course of a few days.

Now if any of your correspondents can introduce a receipt for this composition into the columns of the "Mechanic and Chemist," they will confer a boon on the generality of your readers, and partially do away with the adage, "Letters are strong witnesses." I have tried the muriatic, nitric, and sulphuric acids, but their action on the paper is too speedy, and they change its colour immediately. Perhaps an insertion of this letter may be the means of some interesting experiments being made on the subject.

I am, Sir, yours, &c.

F. HAYS.

Manchester.

[The injury that might be done by this process in the hands of fraudulent persons, is incalculable; bills, receipts, agreements, &c., would be cancelled, and ruin entailed upon thousands; but the antidote must be published with the discovery itself, so that the effect may be prevented, or the process discovered, before it is too late.—ED.]

EVOLUTION OF HEAT.

To the Editor of the Mechanic and Chemist.

SIR,—If I may be allowed to offer an opinion as regards the evolution of heat on the mixture of alcohol and water, it is the following:—All substances that have the greatest specific gravity, in my opinion, have the least latent heat, and *vice versâ*—hydrogen the most, and platina the least. Now when alcohol is added to water, it becomes dense; true, the water becomes lighter, the alcohol becoming denser, must give out a portion of its latent heat; and when water becomes lighter, it must receive a portion of heat which becomes latent. Now the quantity of heat given out by the alcohol, is more than is required by the water, and thus it becomes sensible to the thermometer. There is an exception to this rule, that is, water, which, though

lighter than mercury, still water parts with its latent heat sooner, and becomes solid.

I am yours, &c.

JUVENILE ENTERTAINER.

[When water and alcohol are mixed together, the specific gravity of the compound is greater than the aggregate specific gravity of the two separate liquids. A pint of water and a pint of alcohol, when mixed, will not measure a quart. This circumstance seems to corroborate the doctrine propounded by our correspondent.—ED.]

MISCELLANEA.

Fire-proof and Water-proof Cement.—To half-a-pint of milk put an equal quantity of vinegar, in order to curdle it; take the curd from the whey, and mix it with the whites of four or five eggs; beat them well together; add a little quick-lime through a sieve, till it has acquired the thickness of paste. With this cement, broken vessels of all kinds may be mended; it dries quickly, and resists the action of water, as well as a considerable degree of heat.

Preparation of Drying Linseed Oil.—To render linseed oil drying, consists simply in mixing it with litharge or any oxide of lead; boiling it slowly for some time, and straining it from the sediment after it has stood, to clarify. An ounce of litharge may be used to every pound of oil.

How to Colour Wood or Bone a Beautiful Red.—Take powder of Brazil, and mingle it well with milk, but so that it be very red, and put therein either wood or bone, letting it lie therein eight or ten days, and it will make the said wood or bone red for ever.

A Glue to hold against Fire or Water.—Mix a handful of quick-lime in four ounces of linseed oil; boil them to a good thickness, then spread it on tin plates in the shade, and it will become exceedingly hard; but may be easily dissolved over the fire, as glue, and will effect the business to admiration.

To Catch Kites, Crows, Magpies, &c., alive.—Get nux vomica, beat to powder; this done, take raw flesh or liver, and cut it into little pieces, that the fowls may swallow them whole; then cut holes in the same, and put your powder therein, and lay these pieces where they haunt; but as soon as they have swallowed the same, they will fly to the next tree they come at, and this presently makes them so drunk or sick, that they will fall to the ground; but be sure to watch them and run to the tree, for they will soon recover and fly away.

How to make a Sallad Grow up in Two or Three Hours.—Take lettuce and spinach seed, and soak them in warm oil for the space of half-an-hour; then have fat earth in a hot-bed, to sow them, covering them very lightly over with mould, and they will spring up to admiration, and presently leaf.

E. LEDGER.

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, Sept. 17, W. Vesalius Pettigrew, M.D., M.R.C.S., on the Anatomy and Physiology of the Organ of Hearing. At half-past eight.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, Sept. 16, James Smith, Esq., on Provident Institutions. At eight o'clock.

Franklin Mutual Instruction Society, Half-moon Alley, Lower Whitecross Street.—Monday, September 14, Rev. W. Vidler, on Astronomy. At half-past eight o'clock.

QUERIES.

In No. 91 of your valuable Magazine, there is a receipt by "E. Ledger" for compounding the chemical weather-glass. Well, Sir, I procured the ingredients, and in the exact quantities; pulverized and dissolved them; tied up the bottle, leaving a pin-hole in the bladder as directed, and exposed it to the atmosphere; but no such results took place as mentioned by Mr. Ledger. Thinking I might have made a mistake, I subsequently placed the receipt in the hands of two of the first chemists in this town, with the same results as when I compounded myself. I have several times seen the chemical weather-glass at a friend's house, who does not know the compound, but for which he paid seven shillings, being the price they are sold at in this town. It is a very good indication of the weather; but it presents a very different appearance in the bottle to Mr. Ledger's compound. Now, Sir, as there is evidently a mistake, perhaps Mr. Ledger will be so good as to set me right in your next week's publication. A. C. P.

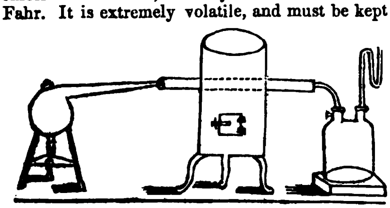
If any of the readers of the "Mechanic and Chemist" have for sale cheap, a small working model of a steam-engine, with or without boiler, they will oblige by sending particulars; and time when and place where the same may be seen, to Mr. Thomas, No. 38, Ludgate Street, City? C. THOMAS.

ANSWERS TO QUERIES.

"N. M. T." S. F. Gray says, that the catananche cœrulea is the blue gum succory; that its properties are aperitive, hepatic, and attenuant; roots, dried and powdered, used to improve (?) coffee. (Third edition, Suppl. to Pharmacopœia, 1824.

Sulphuret of Carbon.—Coat an earthen tube with clay, and pass it through a furnace. Put into the tube several pieces of newly-made charcoal, arranged so as not to choke up the tube; to one end attach a bent glass tube, jetted to a two-neck Wolfe's bottle, partly filled with water; to the neck of the bottle affix a safety tube. Let a small retort be luted to the other end of the tube, and into the retort put some sulphur. When the tube is red hot, put a lighted lamp under the retort; the sulphur will combine with the carbon of

the charcoal, and pass the tube, to be condensed by the water. It will sink into the water, and has a slight milky appearance. When no more gas comes over, detach the apparatus, and pour what has been obtained into a retort containing chloride of calcium; distil by a sand heat of 112° Fahr. It is extremely volatile, and must be kept



in a well-stoppered bottle. Some sulphuric acid put in a vial, and wrapped round with a rag dipped in sulphuret of carbon, presently freezes; and, owing to its almost instantaneous evaporation, it produces a most intense sense of coldness when applied to any part of the body.

Bird Stuffing.—There are many different methods of stuffing, three of which methods I will describe:—The most common method, but which does not answer well for small birds, is to pass wires up the legs and through the head; also into the wings, to make a frame-work for the body, which wires afterwards may be bent, according to the attitude in which the bird is to be placed; then fill up the skin with tow or cotton wool.

Another method, and which is to be preferred for small birds, is to pass a sharpened wire up each leg only, and then to fill up the skin in every part with cotton wool, moulding gradually the bird into its proper form as it dries, and supporting it with wool on every side until thoroughly dry.

Another method, which is peculiarly adapted for those of the genus colymbus, and all large and strong birds, is first to wrap up the bones of the wings with a little tow, and then return them into their proper position; then cut three pieces of annealed iron wire suitable to the size of the bird, sharpen the ends, and pass one through the skull, so as to form an artificial neck (the same size as the one removed) of tow or cotton wool, and wrapt tightly round with twine; two wires are to be passed up the legs, and the thighs made in the same way and manner as the neck. An artificial body is then to be formed and placed in its proper position. Then string the wires of the neck and thighs into their proper direction, and firmly fasten them by twisting the wires into the body. After they are so stuffed, the next business is to sew them up; in doing this, the needle is to be passed from the inside outwards, otherwise the feathers will be ruffled, and the specimen disfigured. Artificial glass eyes will also be requisite, which are to be fixed in with a little common paste, mixed with muriate of mercury; or glazier's putty will answer equally as well.

To Catch Rats—Oil of rhodium (which is the product obtained by destructive distillation of common rose-wood), one part; carbonate of baryta, two parts; mixed up with a little common paste, and set in their haunts.

Stammering.—I do not believe that such a thing as an instrument to relieve stammering is or could be invented. As "A Sufferer" may probably not understand the cause of stammering, I will take the liberty, as well as I am able, to explain it to him:—Affixed to the front of the larynx (the upper part of the wind-pipe) is a small flap of cartilaginous matter styled the epiglottis, which serves a very important office—viz. the larynx being situated in front of the œsophagus (food pipe), the food eaten must necessarily pass over the entrance to the larynx, which, if it were to enter, would cause suffocation; but, to prevent that, while swallowing, the epiglottis shuts over the larynx, and allows the food to pass over and enter the œsophagus. Some of your readers may, perhaps, have experienced the effects of trying to speak whilst swallowing, as the epiglottis must open when you are proceeding to speak; the food of course enters and chokes the person. From this we deduce, that stammering arises from the muscles which raise the epiglottis being incapable of so doing, through a morbid state of the nervous system. Hence a person can sing or drawl out a sentence without stammering, as, during that state, the epiglottis continues open. And the great secret of those empirics who profess to cure stammering, consists in making their patients to drawl out their words in quick succession, so as not to allow the epiglottis to close.

Congreve Fusees are made in the same manner as the Congreve matches; excepting German tinder being substituted for wood.

MANIPULATOR.

TO CORRESPONDENTS.

J. A. P.—*It was reported in the newspapers some time ago, that a French chemist had discovered a substance which, enclosed in a glass vessel, would exhibit a perpetual light; but the story did not appear sufficiently connected with truth, to create any interest in the scientific world. Phosphorus may be kept in a well-closed bottle, and it will emit a light when exposed to the air; but it is not unattended with danger.*

S. P.—*No.*

Joseph Rice (15, Duke Street, Manchester Square) *has invented an apparatus for preventing loss of life by shipwreck, &c. Besides fulfilling the indispensable conditions,—certainty of action, and facility of application—it appears, from the inventer's account, to possess the additional and important advantage of displaying a conspicuous signal. We have given our correspondent's address, in order to facilitate communications from our readers to the inventer. The expense of a patent would be about 300l., or perhaps rather more.*

S. J. W. *may address to Mr. Hedgcock, at the "Mechanic Office," and his letter will reach its destination.*

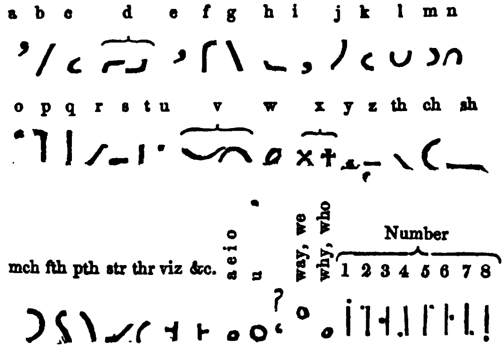
London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by DOUDNEY & SCRYMGOUR (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

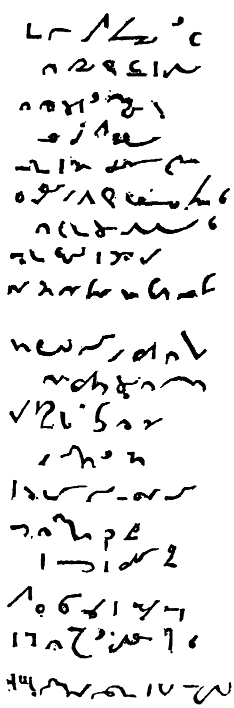
MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

Nos. 110 & 111, NEW SERIES. | SATURDAY, SEPT. 19, 1840. (PRICE TWOPENCE.) | Nos. 231 & 232, OLD SERIES.

SHORTHAND.

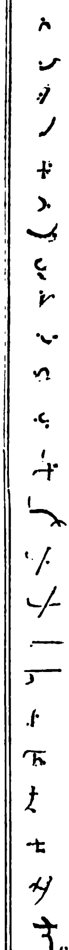




'Tis done—but yesterday a king
And armed with kings to strive;
And now thou art a nameless thing,
So abject, yet alive.
Is this the man of thousand thrones,
Who strewed our earth with hostile bones,
And can he thus survive?
Since he, misnamed the morning star,
Nor man, nor fiend, has fallen so far.

Thine evil deeds are writ in gore,
Nor written thus in vain;
Thy triumphs tell of fame no more,
Or deepen every stain.
If thou hadst died as honour dies,
Some new Napoleon might arise,
To shame the world again;
But who would soar the solar height,
To set in such a starless night?

ILLUSTRATIONS OF THE NUMBERS.



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City Press, 1, Long Lane: Doudney and Scrymgeour.

SHORTHAND.

The brevity of shorthand over all other modes of writing, consists in the simplicity of its alphabet, and its signs for the initial and concluding syllables of words. Besides this, to constitute a good system, not only must the greatest amount of language be exhibited by the fewest marks, but among those marks must be found the largest number of such as are easiest to make. In this, however, all that can be done is, to assign the easiest marks to those letters which are of most frequent occurrence; for the number of simple marks is limited to three, and, by position, to nine; a straight line in four positions, a curve in four positions, and a circle. The remainder of the alphabet must be made up by other contrivances. To effect this, some combine the circle with a straight line or curve. These lose a great advantage in representing the vowels, and rendering the writing legible. Others combine two straight lines to represent a character, which must introduce great confusion. An odd-looking sort of thing, published a year or two back, intended to supersede, not only all other systems of shorthand, but also common writing and printing, varies the simple marks in a wonderful manner, thickening and thinning them, in whole or in part, tailing them, and placing them at all imaginable angles. Indeed, the characters are actually laid down, with *scale* and *protractor*, in a geometrical scheme. Such crude attempts carry their own absurdity upon the face of them, and prove their writers to be mere experimentalists upon public credulity, and to know nothing of the first principles of shorthand, much less to have practised it. Blanchard, whose system I have always congratulated myself upon learning, uses characters of two sizes, small and large, as we have short and long letters in common writing; this is of the greatest possible advantage in exhibiting the vowels and primary and concluding syllables. The objection which some have made, as to the difficulty of preserving two sizes in swift writing, is no objection at all, as I can testify, from eighteen years' experience, both in my own practice, and the practice of many who have studied under me. In common writing, when written at the swiftest, it is easy to distinguish between *l* and *i*, *a* and *d*; and, to shorthand writers, shorthand is precisely the same. Some improvements have been borrowed from Mavor, and, indeed, from every other system that offered advantages. Time, much time, and much practice will be required before the learner can follow a speaker, and, to tell him otherwise, would be only to deceive him. If persons are not willing to bestow that time and practice, they must not attempt it, and there the matter rests. If an individual refuses to learn arithmetic, because three months' study of it will not make him master of the calculus, why, he must remain as he is. But, let it be clearly understood, that though it will require much time to write as fast as another speaks, yet three or four months' practice will enable any one to write three or four times as fast as in common writing, and, after a little public practice (for there is a knack in listening and writing at the same moment, which nothing but public practice can teach) to catch the *leading ideas* of moderate speakers, which is all that the best shorthand writers can accomplish in following *very rapid speakers*, and which, indeed, is all that is necessary. By taking the trouble to compare the reports of speeches in the daily papers, it will be found, that though the sense is the same, yet they are not verbally alike. At a future time, I may enter into detail, and explain several methods of abbreviation, which experience and time have suggested; for the present, the following will be sufficient to give the reader an idea of the manner in which he may proceed. Suppose a speech copied thus by two reporters:—" Lords Gemn. Eyes all Europe moment on you. From your resolutions, Protestant interest hopes protection well as friends, preservation independency; enemies fear final disappointment, ambitious destructive views. Let these hopes fears confirmed augmented by vigour unanimity dispatch proceedings." The translation of one might be:—" My Lords and Gentlemen,—The eyes of all Europe this moment are on you. From your resolutions, the Protestant interest hopes protection, as well as our friends the preservation of their independency; and our enemies fear the final disappointment of their ambitious and destructive views. Let these hopes and fears be confirmed and augmented by the vigour, unanimity, and dispatch of your proceedings." The other might give it:—" My Lords and Gentlemen,—The eyes of all Europe are, at this moment, directed upon you. From your resolutions, the Protestant interest confidently hopes for protection, as well as our friends for the preservation of their independency; while our enemies are overwhelmed with fear for the final disappointment of their ambitious and destructive views. Let these hopes and these fears, then, be confirmed and augmented by the vigour, the unanimity, and the dis-

patch of your proceedings." The first thing the learner must do, is to write the alphabet over carefully, committing perfectly to memory the words which the letters signify; which are the following:—

A, a, an	*n*, and, in
b, be, by, been *	*o*, oh, of
c, can	*p*, people, peace
d, did, day, do, done	*q*, question, quantity
e, ever, every	*r*, are, our, or
f, for, from, if	*s*, as, is
g, God, go	*t*, the, to, it
h, he, has, had, his	*u*, you
i, I, eye	*v*, have, save
j, Jesus, judge	*w*, which,
k, king, know, knew	*x*, exercise, extra
l, Lord, all	*y*, ye, your, yes
m, me, my, may, him, am	*z*, zeal.

th, they, that
ch, Christ, chapter, change
sh, shall, should
mch, much, inasmuch as
fth, faith, forth, father, farther
pth, path, pathetic
str, stir, star, store, strong, strength
thr, there, their, therefore.

The commas and dots for the vowels are used only when standing alone. In composition, a little circle is used for *u*, *e*, *i*, *o*; a larger one for *u* and diphthongs. When the small circle stands alone, at the top of the line, it signifies way or we; when at the bottom, why or who. Of the numbers, the first four are for primary syllables; the others for terminations.

No. 1 signifies com, con, coun, cum, ab, ob, trans.
No. 2. Au, aw, re, anti, inter, intro, inde.
No. 3. Pra, pre, pri, pro, pru, par, per, pir, por, pur, prin.
No. 4. Un, under, mis, mus, dis, dus, sub.
No. 5. Ary, ery, &c.; aty, ety, &c.; ify, ophy, &c.
No. 6. Ation, etion, &c.; assion, ession, &c.; ician, tion, ion, &c.
No. 7. Ant, ent, &c.; ate, ete, &c.; ance, ence, &c; anse, ense, &c.; ness.
No. 8. Ang, ing, &c.; li, ed, ful.

That is to say, a dot put in the position of No. 1, that is, above a letter, signifies com, &c.; thus, a dot with *n* under it, signifies common; and *k*, with a dot under it (No. 8), knowing; for *k*, of itself, stands for know, and the dot for ing; and so of all others. By using letters instead of the dots, three syllables may be expressed by one mark, as shown in the plate. It will be seen, that there are two *d's*, *v's*, and *x's*; either may be used; *j* is also substituted for *g*, when easier to join. The method of contraction will be best learnt from making out the title-page: no rules can teach it. Put just as many letters, consonants, and vowels, as will be sufficient to convey the sound; *x* is formed by making two letters cross each other, and is to be used for all such sounds as ack, eck, ick, &c. Should the learner find any difficulty, I shall always be willing to obviate it. W. W.

* This letter is also sometimes used for *y* in composition.

ON THE ATTRACTION OF COHESION AND CAPILLARY ATTRACTION.

If two bodies be immersed in water, so that the tops of them be as much below the surface of the water as they will sink to, without the water spreading over their tops, I say they will repel or recede from each other; nor will any floating body or atom approach either of the bodies so immersed. But if the same bodies are permitted to float with their tops up above the level of the water, I say that they will approach each other, and every body floating on the surface of the water will approach all bodies so floating. The principle upon which this depends, is simply the adhesion of the particles of the water. We know that drops of water hang to the sides by reason of adhesion among the particles of water that make up the drop, by which every particle, to a certain amount of particles, is maintained, the water having a proper affinity to the side, &c. And we know, likewise, that water will be maintained up above the brim of any cup or dish, by reason of adhesion among the particles of the fluid, and the resistance it likewise meets with on the edge of the cup; and, lastly, we know that water, by reason of adhesion among the particles, will hang to the side of any body and will, if the body be placed in the fluid, hang from the body all round, like a ring slanting from the body down to the water in a sudden curve. Let us call this ring, of water a vortex; and if two bodies floating on the surface of the water, with their tops up above the surface, be brought so near to each other, that the vortex of the one body just touch the vortex of the other, I say they will then, and only then, begin to approach each other. The vortices extend from the bodies at the sur-

face of the water, about three-sixteenths of an inch.

You will see that the two bodies are connected together the moment the vortex of the one touch the vortex of the other, by reason of the adhesion among the particles of the two touching vortices of water. The vortex of the one body slanting down to the point of contact, and up again to the other body, forms a compound vortex of the two; and the instant the vortices touch, they will join to each other outwards on either side, if they happen to be convex to each other, by reason of the water naturally disposing itself from the most acute joining to the most obtuse and uncornered form it can assume. Now let the joining of the two vortices be any number of particles in breadth, and one particle of water in height; the bodies may not begin with this power to approach each other; however, let it be supposed they do begin to move, I say, then, the power that is at this moment drawing the two bodies together, is as the height of the row of particles multiplied by the weight of the row of particles in the section that divides the two vortices; and, of course, this is the measure of the adhesion of all the particles in the section. But it is evident the bodies will begin to approach each other, when the weight of the particles across the section of the compound vortex between the two bodies, is greater than the inertia or tendency the bodies have to remain at rest in the fluid; for particles at the section hang upon both bodies alike by virtue of adhesion to the particles which adhere to the bodies, and, of course, will fall down from between the two bodies, if they be not upheld by the bodies being prevented from following up the direction that the particles immediately in connexion to these in section, will necessarily be drawn to by the weight of the particles in the section. The weight of any part of the vortex round the bodies only hangs as dead weight on them, and can have no other effect on them, than what it had before the touching of the vortices. I allude to the sound parts of the primitive vortices, opposite to where they are connected between the two bodies.

Why the same bodies, immersed below the surface of the water, but not covered or wet by the water on the top, repel or recede from each other, follows almost as a corollary to the preceding case. It is evident that the vortex, suspended from the bodies floating above the surface, will now be suspending the body immersed beneath the surface of the fluid, by reason of the adhesion among the particles of the vortex, which rises up from the body about three-sixteenths of an inch, and vanishes into the surface of the water about four-sixteenths of an inch from the side of the body; the same distance from the body that the water will rise upon the body above the surface of the water, and the height of the surface of water above the top of the body, is the same as the distance the vortex will extend from the body above the surface, till it vanishes into the surface of the water, namely, three-sixteenths of an inch. Take one body with its depressed vortex of water, and let another body touch the vortex in any part at the top, it is evident that the level of the vortex at that place is broken and depressed by the weight of the body or its touching; if it be a body that will float on the water, it will instantly seek the highest place in the vortex, and will seem to be repelled from the body immersed; but if it be a body simply presented by the hand, the vortex and body will both seem to be repelled by the object; for, as the vortex will be broken by the object, it follows that the surrounding level of water will force against the body, to restore the equilibrium in the level of the vortex at the part depressed; for the same reason would the vortex and body seem to be repelled by a thin blade, if it be used to represent the single phenomenon more complex by bisecting or cutting the vortex in two, vertically to the side of the body. In this case, the two opposite sides of the vortex, having no support between them, the blade having severed the part of the vortex away that kept the whole complete like an arch, will instantly be forced by the surrounding weight of water to flow over to either side, till the whole level of the vortex be again complete between the immersed body and the blade. Two bodies, so immersed, will recede from each other to the distance of twice the height vortex stands upon bodies floating above the surface of water.

Of capillary attraction, as it is called, I say there is no such thing as attraction or repulsion about it; but simply the water rising, and maintained when up capillary tubes, by the adhesion of the particles of water to the sides of the tube; and, as I have observed in the preceding cases, regarding water being suspended from the sides of all bodies it has a proper affinity to. It may here be remarked, that no body whatever can have a vortex of water suspended from its sides, unless it be previously wetted above the surface of the water; therefore, I say, the capillary tube must first have a coat of moisture on

the inside of the tube before the water will rise in it.

In the first place, then, let a tube be furnished, that will exactly contain a vortex of water that will just fill the tube exactly, vanishing away from all points of the circumference, at a point in the very centre of the tube; I say such a tube shows the phenomenon of water rising up capillary tubes in its first and simplest form, and is actually all that we see in all tubes whatever. The quantity of water contained in this tube, is the greatest quantity that can be contained in a capillary tube less than it.

The quantities of water in all capillary tubes, are as the diameters of the tubes. The heights to which the water ascends in all capillary tubes, are reciprocally as their diameters; and, consequently, the surface by which the water is supported in all capillary tubes is the same. But I say, the weights of water in all capillary tubes, supported by the same unalterable surface, must be the same; for the weight of a column of water in the tube is as the height of the column multiplied by the area of its base; therefore, I say, if the first simple form of capillary attraction is only water supported by the adhesion of the water to the sides of the tube, every other expression of the phenomenon is maintained by the very same cause. This, then, is first the case when the wet lining of the tube touches the water. The particles of water immediately in contact with the particles of the lining of tube, are supported by the lining; for the power of adhesion of the particles to the tube, and among themselves, is shown to be sufficient to bear a weight equal to the first vortex, or equal to a drop of water, to be plainly understood. But the water being directly supported by adhesion to the height first of one particle, the particles immediately in connexion with the sides of the tube will dispose themselves, without any hinderance, up the tube, in a form common to the most relieved condition of their surface, which will be, as on all other surfaces or floating bodies, a curved top, slanting up to the particles immediately above themselves; and, as the particles in the very centre of the tube, multiplied by their height, are not so heavy as the adhesion is of the particles to the tube, and, among themselves, is strong, I say, the water will actually be drawn up the tube by the slanting particles that dispose themselves up the tube from the surface of the water; for, as I have already observed, the slanting particles are supporting no weight, till once the area of the column of water, multiplied by its height, be equal to the power of adhesion of the whole surface of particles.

I am, Sir,
Most respectfully yours,
M. Sproule, Eng.

LEIGH'S IMPROVED MODE OF OBTAINING WHITE LEAD.

(Abstract of Specification.)

Firstly, I take a quantity of the lead ore, called galena, say eighty-nine hundred weight, reduced to moderately fine powder, and to this I add so much nitric acid diluted with water, as shall dissolve the lead of the galena—say one hundred and fifty hundred weight of nitric acid, of the specific gravity 1.3, diluted with three or four times its bulk of water; by the aid of a gentle heat, the acid and galena readily act on each other, and a solution of nitrate of lead is formed. To this solution, when clear, I add a concentrated solution of common salt, or chloride of sodium, so long as any precipitation of chloride of lead takes place; then the chloride of lead having subsided, and the supernatant liquor being decanted, I wash the chloride of lead with fair water, adding the first washings to the previously decanted liquor, which will consist of a solution of nitrate of soda; but I do not confine myself to this mode of making the chloride of lead, as it may be made in various other ways, as by the decomposition of any of the soluble salts of lead, by the soluble chlorides of other substances, or by the action of muriatic acid or litharge, or of the same acid on the acetate of lead, &c. To the chloride of lead, however obtained, I add a quantity of the purified liquor, prepared from the ammoniated fluid formed in the manufacture of coal gas, and commonly called gas liquor or gas water, or of the purified liquor obtained in the distillation of putrescent human urine, or of the purified matters resulting from the distillation of bones or other animal matters; and which purified liquors are thus prepared:—The ammoniated liquor obtained during the manufacture of coal gas, and commonly called gas liquor, is to be introduced, after any tarry matter has been carefully separated from it, into a distillatory apparatus connected with a receiver, which should be kept cool; a common iron waggon-shaped boiler connected with a receiver, will answer very well. A quantity of liquor is to be distilled over by a gentle heat, somewhat below boiling, equal to a little more than one-third the quantity of crude gas liquor introduced.

By this treatment, the whole of the volatile salts contained in the gas liquor, will pass over into the receiver; the receiver will contain a moderately-concentrated solution of carbonate of ammonia, mixed with a little hydrosulphate and hydrocyanate of ammonia; should any oil appear in the liquid, it is to be carefully removed or skimmed off. To the liquor must then be added some salt of lead; I prefer to use the carbonate, which should be finely powdered, and added so long as any blackness is produced. The sulphur is thus separated from the liquid, and the sulphuret of lead formed, may be decomposed by dilute nitric acid. When the salt of lead ceases to be coloured by the liquid, the latter should be allowed to stand till clear, and then decanted from the precipitate; and, if not sufficiently colourless, redistilled by a gentle heat, when it will be ready for use. When any solid carbonate of ammonia forms on the upper part or sides of the receiving vessel, it should, after the distillation, be dissolved in the liquid portion collected; or the ammoniacal salt may be procured solid by the repeated distillation at a moderate temperature of the fluid distilled from the crude gas liquor, the salt rising and condensing in the apparatus; this should be desulphurized after the first distillation, in the manner hereinbefore described. The solid salt, mixed with a quantity of animal charcoal, may then be introduced into a proper apparatus and sublimed, by which means the carbonate of ammonia will be obtained very pure; and the solution of this in water will form a fluid fit for use. When wine is employed instead of gas liquor, it should be allowed to stand for a few days in a covered vessel, then introduced into the distillatory apparatus, and about three parts distilled over for every ten parts of wine introduced. The distilled portion will consist chiefly of a solution of carbonate of ammonia; a little carbonate of lead should be mixed with this, to separate any sulphur that may be present, and any oily matter carefully removed. The liquor being decanted and redistilled, will be fit for use. When bones or other solid animal matters are employed, they should be introduced into an iron retort, connected with a series of reservers, as is ordinarily done in the process of distilling these matters for the manufacture of sal-ammoniac and bone-black. The products of the distillation collected will be solid and liquid, consisting of solid carbonate of ammonia, hydrosulphate and hydrocyanate of ammonia, and much oil. The oil should be carefully removed as completely as possible, the liquid portion freed from sulphur, as described in speaking of gas liquor, and redistilled till sufficiently colourless, whilst the solid portion, mixed with animal charcoal, may be sublimed; then dissolved in water, and also freed from sulphur, if necessary, or it may be at once dissolved in water, freed from sulphur by carbonate of lead, and distilled to render it colourless.

Having described the mode of preparing these ammoniacal solutions, I shall now proceed to state how they are to be used in the manufacture of white lead. On the chloride of lead washed, I pour any of these solutions gradually, and with constant stirring, so long as any decomposition takes place, some effervescence occurs from the escape of carbonic acid. I allow the chloride of lead and the liquors to remain together for twenty-four or thirty-six hours, with occasional agitation, in which time the metal decomposition will be completed, the ammonia being converted into a muriate, and the lead into a mixed carbonate and hydrated oxide. This operation should be conducted in broad shallow vessels, to allow of the exposure of considerable surface. After standing, the liquor should be decanted, and the mixed carbonate and hydrated oxide well washed with water, the first washings being added to the decanted liquor. The quantity of the purified gas liquor, or other ammonial solutions necessary for the decomposition of a given weight of chloride of lead, will necessarily vary with the strength of those liquors, but will be easily determined, by trying the strength of the liquors by the quantity of an acid, as the muriatic necessary for their neutralization. This being ascertained, it will be easy to calculate the quantity necessary for a given weight of the chloride of lead. I find that the chloride of lead, obtained from the quantity before stated, of galena and nitric acid, is decomposed by the purified liquor, obtained from about 7466 gallons of crude gas liquor. After the mixed carbonate and oxide of lead, formed as above described, has been well washed, I pass through it, in any convenient apparatus, a current of gaseous carbonic acid, so as to convert it into a perfect carbonate of lead, which is to be washed, dried, and ground, in the manner usually practised, and which is well understood; for the chloride of lead employed in the process just described, sulphate of lead may be substituted, precisely the same processes and operations being required. The results in this case will be sulphate of ammonia and mixed carbonate and hydrated oxide of lead, the latter of which is to be fully carbonated by gaseous

carbonic acid. The sulphate of lead may be formed by the mutual decomposition of acetate of lead, and the sulphate of alumina and potassa or common alum, as is often practised, or by the decomposition of any of the soluble salts of lead, by the alkaline or soluble earthy sulphates or sulphuric acid. In my second process, instead of using the chloride or sulphate of lead, as hereinbefore described, I add gradually, and with frequent agitation, a solution of the nitrate or acetate of lead to the purified ammoniated liquors, so long as any precipitation is produced, whereby are formed perfect carbonate of lead and a solution of nitrate or acetate of ammonia, the carbonate of lead being precipitated; after the carbonate of lead has completely subsided, the supernatant liquor should be decanted, and the carbonate of lead well washed; the first washings being added to the first decanted liquid. The carbonate of lead must then be dried and ground in the usual manner. The precipitation of the carbonate of lead should be conducted in a vessel which can be closed after each addition of the solution of nitrate or acetate of lead, and the mixture then agitated, so as to prevent the escape of much carbonic acid. In my third process, I decompose the chloride or sulphate of lead, by pouring upon it gradually, and with continued stirring, a solution of the sesquir-carbonate or bi-carbonate of ammonia, using such sesquir-carborate as is prepared for the purposes of commerce; for every 140 parts of chloride of lead, or 152 parts of sulphate of lead, I use a solution of fifty-nine parts sesquir-carbonate of ammonia or seventy-nine parts bi-carbonate of ammonia. Considerable effervescence takes place on the mixture of the chloride or sulphate of lead with sesquir-carbonate or bi-carbonate of ammonia, and there is formed sulphate or muriate of ammonia and perfect carbonate of lead. This process should also be conducted in a vessel that can be closed after each addition of the materials; and during the agitation of the mixture, it will be unnecessary to transmit gaseous carbonic acid through the carbonate of lead formed in this case; as, if properly conducted, the lead will be fully carbonated. There is nothing in these operations, requiring such a particular form or apparatus, as to render its description necessary in the distillatory operations; the stills or boilers may be of iron; the condensers, and all the other utensils required, will be best of lead. Now whereas in these processes, I do not claim the mode of decomposing nitrate of lead by common salt, nor any particular mode of forming chloride or sulphate of lead; nor do I claim the method of converting the mixed carbonate and hydrated oxide of lead into perfect carbonate of lead by gaseous carbonic acid. But I do claim the mode of making nitrate of lead from galena and dilute nitric acid, and also the mode of decomposing the chloride, sulphate, nitrate, or acetate of lead, by the purified gas liquor, or the purified liquor from distilled urine, or the purified matters from distilled bones and other animal substances. I also claim the method of decomposing the sulphate or chloride of lead by a solution of sesquir-carbonate or bi-carbonate of ammonia, whereby the use of gaseous carbonate acid is rendered unnecessary. I do not claim the mode of concentrating the gas liquor by distillation, as that has been done before; but I claim the method of purifying it by distilling it, and separating the sulphur by means of a metallic salt, by which it is rendered fit for the manufacture of carbonate of lead.

STEELE'S PATENT RANGE, AND APPARATUS FOR HEATING WATER.

(Abstract of Specification.)

Fig. 1, which is an elevation of our improved range, A, represents a boiler calculated to obviate any defects, and which is made sufficiently high, to admit of water being drawn off from it at any suitable level, for the purposes aforesaid, and to leave space at the top of the boiler, for the generation of steam for culinary purposes. We prefer making this boiler, where circumstances will permit, above two feet more or less, above the level of the bars of the range. In addition to the advantage of this increase of height of the boiler, we also supply the means of cleansing out the inside of the boiler, much more effectually than has hitherto been attained by other means, and are thereby enabled to heat the water at a less expense of fuel. In order to effect this, we proceed to state, that in fig. 3, which is a back view of our improved apparatus, B represents the supply pipe, the orifice of which we carry up within the boiler, to the level of the top of the angle of the front of the boiler, as is shown by the dotted lines, instead of fixing it at the bottom or end, as is commonly done. This is farther illustrated by reference to fig. 4, which is a section of our improved range,

in which figure the pipe, B, is exhibited as ascending to the top of the angle of the boiler; but, in some instances, we carry up this pipe still farther within the boiler, or to any height sufficient to effect the cleansing out of the boiler. In fig. 3, C is an exit pipe, opening at the bottom of the boiler. This pipe is led under the floor of the kitchen flat, and from thence to the nearest cess-pool, drain, or sewer of the house, at which point, or at any other intermediate place, a stop-cock is attached for opening or shutting this pipe during the cleansing of the boiler, or otherwise; and between this stop-cock and the boiler, we attach branch pipes to the pipe, C, for leading hot water from the boiler to the various places on the ground floor, or wherever it may be wanted. To supply this boiler with water, either for culinary purposes or otherwise, or for cleansing it out, a small auxiliary

FIG. 1.

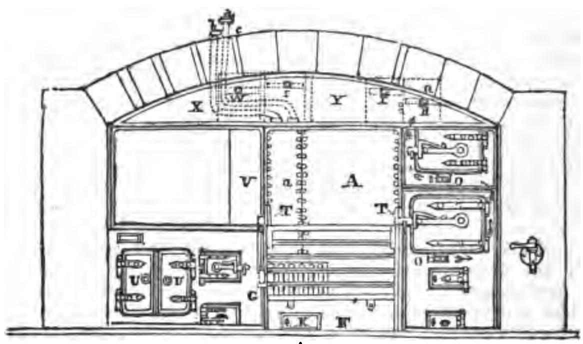
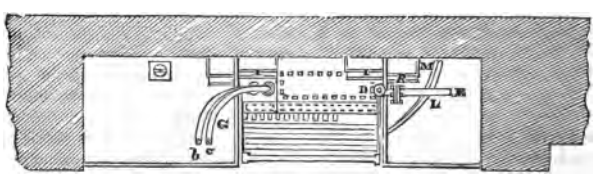


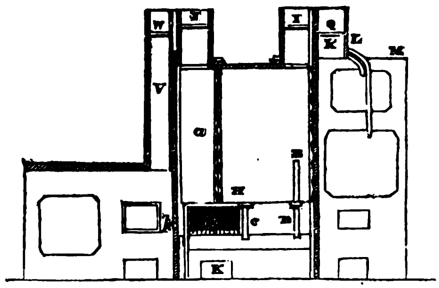
FIG. 2.



cistern is to be placed in any convenient situation, so as to be capable of filling the boiler to within about nine inches from the top, such space being necessary for the generation of steam; the level of the water in this cistern being regulated by a ball-cock in the usual way. This boiler is also provided with a steam-valve, D, and a pipe, E, seen in figs. 2 and 4, for conveying steam to the cooking apparatus, or for heating closets or presses in the usual way. The boiler may be formed of plate-iron or other suitable material; and, in order to make it as efficient as possible for heating water and producing steam, we cause the fire of the kitchen-grate to act on the front, bottom, and back of the boiler; and to cause the fire to act on the bottom and back of the boiler, we shut up the space below the grate with a face plate, F, fig. 1, of iron or other suitable material; so that no cold air can get in behind the boiler, by which also any draught there can only take place by drawing in the heat and flame of the fire through bars, G, seen in figs. 1, 2, 3, and 4, and over their tops at an aperture, H, seen in fig. 3, below the boiler; and the intensity of the heat is regulated by opening or shutting, in a greater or less degree, one or other, or both of dampers, I, placed at the top of the flues, seen in figs. 1, 2, 3, and 4. The face-plate, F, is provided with a door, K, opening with hinges, and a suitable fastening thereto, which is opened as occasion requires, for clearing out the ash-pit below the grate-bars, G, and to facilitate which clearing, these bars, G, are cast in separate pieces, to admit of their being taken out, and thus open a passage to admit of the whole space behind being cleared out. These bars are formed or

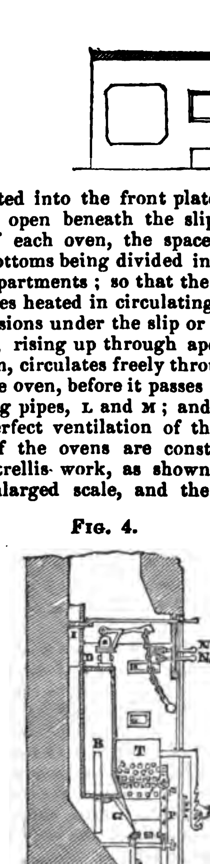
cast with ⊤ ends, and rest upon horizontal bars at each extremity thereof. Both ovens are completely ventilated by means of pipes, L and M, seen in figs. 2 and 3, from the back of each oven, and these are terminated by slide valves, N, at the top of the ovens, as seen in section, fig. 4. To admit a current of fresh air, slide valves,

FIG. 3.



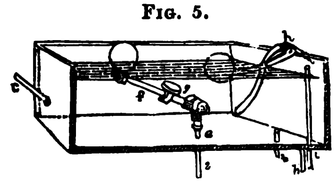
O, are fitted into the front plate, fig. 1; and these open beneath the slip or false bottom of each oven, the space between the two bottoms being divided into two or more compartments; so that the entering air becomes heated in circulating through these divisions under the slip or false bottom, and, rising up through apertures in the bottom, circulates freely through every part of the oven, before it passes off by the ventilating pipes, L and M; and, to effect a more perfect ventilation of the air, the shelves of the ovens are constructed of open or trellis-work, as shown in fig. 6, on an enlarged scale, and thereby pre-

FIG. 4.



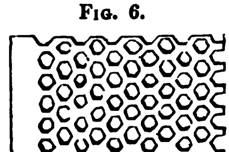
vents anything undergoing the process of cooking, from being chilled by air admitted through an aperture in the oven doors, as has been the case hitherto. This heating of the air previous to its coming in contact with the dishes, also prevents that condensation of their vapours, which takes place by allowing cold air to act upon them in the usual way, an evil which renders baking or roasting much less perfect than is attainable by our method of ventilating. The ovens are so constructed, that they are heated by the fire of the range passing into their flues at an opening, P, seen in fig. 4; after which the

FIG. 5.



heat circulates around the ovens in the direction of the arrows seen on the front plate of the ovens, fig. 1, and then up a flue, Q, figs. 1 and 3, into the chimney; and, to regulate the draught, this flue is provided with a damper, R, seen in figs. 1, 2, and 3. The bottom and side of the lowest oven are protected from the intensity of the fire by means of safe plates or saddles, S, seen in fig. 4; and the ends or cheeks of the grate are also protected by safe plates, T, seen in figs. 1 and 4. The boiling table or hot plate, is fitted up with

FIG. 6.



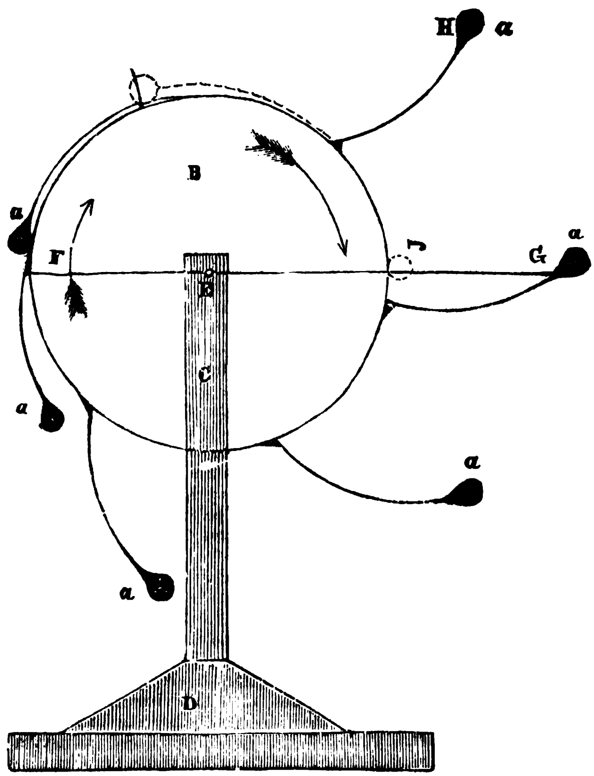
a hot-press, the folding-doors of which are seen at U, fig. 1; and, in order to heat this table, we cause a portion of the flame and smoke, or heat of the fire, to pass into the flues of the table, and to circulate

under the top plate, which is provided with a flue-plate for that purpose, but which is not seen in the drawing; and from thence the flame and smoke pass up a flue, V, seen in figs. 1 and 3, and which flue is provided with a damper, W, seen in the same figures, by the opening or shutting of which, the temperature of the table is regulated. The aperture at which the fire enters the flues of the table, is similar to that already described for the ovens, and seen in fig. 4, at P. The boiling table is also provided with a ventilating door, but which is not seen in the engraving; it is fitted into the cheek-plate and opening behind a face-plate, X, fig. 1, for the purpose of preventing any vapour or burnt smell arising from the cooking, finding its way through the house; and this vapour flies off by the door and escapes behind another fire-plate, Y, above the range-fire into the chimney.

We shall next describe our method of raising the temperature of water for baths and other uses. To the vessel, *a*, the pipe, *b* and *c*, seen in figs. 1, 2, and 5, are attached, and the pipe, *b*, is made to descend within the heating vessel, till within about one and a half inches of the bottom; and the other end of this pipe leads to the reservoir, and opens about an inch above the bottom of the said reservoir, or as far above it as to prevent any sediment which might otherwise descend by that pipe along with the water, and which is placed at a higher level than the baths; and through this pipe the water from the reservoir descends into the heating vessel, to be there heated and forced up again into the reservoir; and the other pipe, *c*, leads from the top of the heating vessel, and terminates at or about six inches above the bottom of the said reservoir, as seen in fig. 5, and by this pipe, hot water ascends up into the reservoir, by the greater gravity of the cold water in the pipe, *b*. In order to take off the water to the baths, or to any other place where wanted, a pipe, *e*, seen in fig. 5, is inserted into the bottom of the reservoir; and, upon the opening of this pipe, there is another pipe, *f*, seen also in fig. 5, fitted by means of a screw or other coupling; this pipe, *f*, turns upon a joint immediately above its coupling, to the pipe, *e*, so that its upper orifice can be moved to any level in the reservoir, and so drain off the water there, at whatever level it may be; and, to effect this rising or falling of the mouth of this pipe, *f*, a float-ball is attached to it, in such a way, as to keep the upper orifice of the pipe about three inches below the surface of the water in the reservoir; and to adjust the buoyancy of this float-ball to the degree of depth required, a weight, *g*, also seen in fig. 5, is attached to the pipe, *f*, so that the depth of the orifice of that pipe, below the surface of the water in the reservoir, can be easily regulated at pleasure, by shifting the weight up or down the pipe, as the case may require. The object of this pipe, *f*, is to run off the hottest portion of the water in the reservoir into the baths, and this can be done only by drawing off near the surface, as the natural tendency of heat is to ascend. Our apparatus being so arranged, hot water is run off from the reservoir, through the pipes, *f* and *e*, immediately on a stop-cock or valve on that pipe being opened, in connexion with the bath or other place, where the water requires to be drawn. In addition to the parts now described, the reservoir is provided with a supply-pipe, *h*, see fig. 5, the orifice of which is led down to the bottom of the reservoir, so as to occasion as little intermixture of the cold water with the hot, as possible. The supply of cold water is regulated by means of a stop-cock and ball on the pipe, *h*, in the usual way, and a waste-pipe, *i*, is placed for clearing out the reservoir, and as an overflow-pipe for carrying off any surplus water, in the event of any derangement of the ball-cock on the supply-pipe, *h*. In order to cleanse this heating vessel, *a*, a pipe, *k*, is attached to it, seen in fig. 3, and having a stop-cock on it, at or near the same point as the cock on the pipe, C; it proceeds along the floor of the kitchen flat, in the same direction as does the cleansing-pipe, C, of the boiler, A; and a little beyond the stop-cock of this pipe, it is joined to the said pipe, C, and which latter pipe (on opening the cock of the pipe, *k*) then serves as a discharge-pipe, for both the boiler and heating vessel, and thereafter communicates with the cesspool, or the drain, or sewer, as already described, in regard to the boiler, A. It is obvious, however, that the access must be provided for using the stop-cocks at the junction above referred to; and in order to this, an opening must be made in the floor for the purpose, and may be covered with a plate of iron or a stone, fitted into a suitable recess, cut for its reception; or the cleansing water of the heating-vessel may be discharged at any other point more convenient. In either case, during the time that the water within the heating vessel is being run off, pure water is allowed to descend into it from the reservoir above, and, falling into it, stirs up all sediment, and thus clears out the heating vessel; and the same process is employed

for the range-boiler, A. In both cases it is necessary that the exit or discharge-pipes should be of greater area than those by which the water runs into the boiler or heating vessels during the cleansing process; otherwise the water cannot be emptied from these vessels fast enough to form a space for the entering water falling into, which would render the attempt at cleansing abortive.

PERPETUAL MOTION.



To the Editor of the Mechanic and Chemist.

SIR,—I had long entertained an idea, like many others, that the tantalizing object, perpetual motion, might one day be accomplished; until somewhat convinced by theory of my error, by which I was so influenced, that the schemes I have devised to effect the accomplishment of the same, are indeed very numerous, one of which may not prove uninteresting to some of your many readers, as for its simplicity, I think it stands unrivalled. If you should think it worth insertion, it might lead some of your intelligent correspondents not to laugh at me, but to make some just comments thereon, which might tend to edify a portion of your readers, myself included.

I am, Sir, your obedient servant,

J. C. S.

Description of Engraving.

B is a wheel, to the circumference of which is attached a series of steel springs, and to the end of each of these is a metal knob, *a*; E is the axis of the wheel, which works in the upright, C; D is the stand. Now as it is evident, that as the

wheel revolves in the direction of the arrows, so will the springs continue to project one after the other in that direction, which, acting as powerful levers, will tend continually to overbalance the opposite side, thereby producing a perpetual motion, if such be possible.

[The weight, H, should have been drawn in the position shown by the dotted line; if the spring were strong enough to lift the weight almost perpendicularly from that point, it would, *a fortiori*, project the ascending weights from the circumference, and thus defeat the desired object. But the fallacy of schemes of this kind is best and most clearly demonstrated by general principles:—Thus, suppose the wheel to turn till F becomes uppermost; if the weight, F, were fixed to the circumference, it would, in its descent to J, exert the same power as if it had descended the perpendicular distance, F J, acting in the manner of a pulley; and the same power would be required to bring it up again to F; but, by the action of the expanding spring obtaining a greater leverage, the velocity of the perpendicular descent of the weight is, and in all such cases necessarily must be, increased; and the power exerted, which can never exceed the whole perpendicular descent, is represented by the line, F G. Now in the ascent of the weight, G, it is evident that more power will be required to raise it from G than from J; and it is not less evident, that the additional power is represented by the line, J G; so that it amounts merely to this:—a force, J G, is gained in the descent, and a resistance, J G, is added to the ascent, therefore no continued motion can result from this combination.—ED.]

GEOGRAPHY OF PLANTS.

THE plants which flourish and thrive in countries remote from each other, offer to the eye of the traveller a series of pictures which, even to an ignorant and unreflecting spectator, is full of a peculiar and fascinating interest, in consequence of the novelty and strangeness of the successive scenes.

Every zone has its peculiar vegetables. At the equator we find the natives of the Spice Islands, the clove and nutmeg trees, pepper and mace. Cinnamon bushes clothe the surface of Ceylon; the odoriferous sandal wood, the ebony tree, the teak tree, the banyan, grow in the East Indies. In the same latitudes in Arabia the Happy, we find balm, frankincense, and myrrh, the coffee tree, and the tamarind. In the thickets to the west of the Caspian Sea, we have the apricot, peach, and walnut. In the same latitude in Spain, Sicily, and Italy, we find the dwarf palm, the cypress, the chestnut, the cork tree; the orange and lemon tree perfume the air with their blossoms; the myrtle and pomegranite grow wild among the rocks. We cross the Alps, and we find the vegetation which belongs to northern Europe, of which England affords an instance. The oak, the beech, and the elm, are natives of Great Britain. As we travel still farther to the north, the forests again change their character. In the northern provinces of the Russian empire, are found forests of various species of firs. In the Orkney Islands, no tree is found but the hazel, which occurs again on the northern shores of the Baltic. As we proceed into colder regions, we still find species which appear to have been made for these situations. The hoary or cold alder makes its appearance north of Stockholm; the sycamore and mountain ash accompany us to the head of the Gulph of Bothnia; and as we leave this, and traverse the Dophrian range, we pass in succession the boundary lines of the spruce fir, the Scotch fir, and those minute shrubs which botanists distinguish as the dwarf birch and dwarf willow. Near to or within the arctic circle, we find wild flowers of great beauty—the mezerium, the yellow and white water lily, and the European globe flower.

We have thus a variety in the laws of vegetable organization, remarkably adapted to the variety of climates; and, by this adaptation, the globe is clothed with vegetation, and peopled with animals from pole to pole. We conceive that we here see the evidence of a wise and benevolent intention, overcoming the varying difficulties, or employing the varying resources of the elements with an inexhaustible fertility of contrivance, a constant tendency to diffuse life and well-being.

With respect to our own country, scarcely one of the plants which occupy our fields and gardens is indigenous. The walnut and the peach come to us from Persia; the apricot from Armenia; from Asia Minor and Syria we have the cherry tree, the fig, the pear, the pomegranite, the olive, the plum, and the mulberry. The vine is not a native of Europe, but is found wild on the shores of the Caspian, in Armenia, and Coromania. The most useful species of plants, the cereal vegetables, are certainly strangers, though their birthplace seems to be an impenetrable secret. The potatoe, which has been so widely diffused over the world in modern times, and has added so much to the resources of

life in modern countries, has been found equally difficult to trace back to its wild condition.* Our fields are covered with herbs from Holland, and roots from Germany; with Flemish farming and Swedish turnips; our hills with forests of the firs of Norway. The chestnut and poplar of the south of Europe adorn our lawns, and before them flourish shrubs and flowers from every clime in profusion. The products which are ingredients in our luxuries, and which we cannot naturalize at home, we raise in our colonies, and man lives in the midst of a rich and varied abundance. And this plenty and variety of material comforts is the companion and the mark of advantages and improvements in social life, of progress in art and science, of activity of thought, of energy of purpose, and of ascendency of character.—*From Whewel's Treatise of Astronomy and General Physics.*

REVIEW.

Guide to Plymouth Breakwater. By J. Claringbull. Devonport: W. Byers; London: J. W. Parker, West Strand.

The importance and manifest advantages of Plymouth Sound as a naval station, have, during the last half-century, attracted the attention of the British Government to various plans for protecting vessels stationed there, from the inconvenience and danger occasioned by its exposure to south-easterly and easterly winds. The present stupendous national work was commenced in 1811, upon the plan suggested by Messrs. Rennie and Whidbey. It is an insulated stone pier, across the middle of the Sound, and about 1700 yards in length. Great difficulties have been encountered during the progress of the work. On the night of the 9th of January, 1817, a tremendous hurricane occurred, when the tide rose to an extraordinary height, and such was the violence of the waves, that 200 yards in length, and thirty in width of the upper stratum of the breakwater was carried away, and deposited on the inner slope of the work. This misfortune, though it created some apprehensions for the permanent security of the work, proved the efficacy of the construction, in producing the desired result to the vessels stationed within it. On the night above mentioned, two vessels, anchored without the breakwater, were driven from their moorings and lost; while those anchored within its shelter, sustained no injury. On the night of the 22nd of November, 1824, another storm occurred, which tore up 748 yards of the work, and nearly 200,000 tons of stone, consisting of blocks varying from three to ten tons, were carried away by the violence of the waves, and deposited on the inner side. Other difficulties of a still more formidable nature are now anticipated; an accumulation of mud within the breakwater, appears to be gradually proceeding, threatening, in the course of time, the total destruction of the anchorage. An enemy has also appeared in the shape of a little animal called *saxicava rugosa;* they are first observed adhering to the stones under water. They are something like the common muscle in appearance, but no larger than pins' heads, till they penetrate five or six inches into the stone, when they increase to about half-an-inch in diameter. Immense quantities of limestone are perforated, like a honey-comb, by these destructive animals; and it is supposed that hundreds of tons are destroyed by them every year.

For a variety of interesting particulars and judicious suggestions, we must refer the reader to Mr. Claringbull's excellent little volume. The accuracy of the information it contains is unquestionable; the author being the son of the late Government surveyor of the breakwater, and having had access to all documents concerning

* The potatoe, now so universally cultivated, was originally imported from America, and the first mention of it appears in the works of the great German botanist, Clusius, in 1588, who had received a present of two of the tubers from the governor of Mons in Hainault, who had procured them from Italy. Peter Cusa, in his Chronicle, printed in 1553, mentions that the inhabitants of Quito, in South America, cultivate a tuberous root, which was used as food under the name of *papas*. This, it is affirmed, is the same plant which had been transplanted to Europe, and which Clusius had received from Hainault, and who placed it among his rare plants. The potatoe in several parts of South America is found growing wild, and is supposed to be indigenous to that country. In Chili, the wild specimens are generally found in steep rocky places, where it never could have been cultivated, and where its accidental introduction was impossible. The potatoe was introduced into England by Sir Walter Raleigh in the reign of Queen Elizabeth, who, within a few years subsequent to 1582, made several voyages of adventure and colonization to that part of the New World. As Sir Walter had a large grant of forfeited land in Ireland, which he planted and colonized, there is the greatest reason to suppose that he introduced the plant into that country almost as soon as it was introduced into England.—*Gardeners' Calendar.*

the work. The engineer, the natural philosopher, the seaman, and the curious visiter, will all be amply repaid by the perusal of the "Guide to the Breakwater;" and we recommend it, with unqualified praise, to the notice and patronage which it deserves.

COAL MINES.

The coal mines of Whitehaven may be considered as the most extraordinary in the known world. They are excavations which have in their structure a considerable resemblance to the gypsum quarries of Paris; and are of such a magnitude and extent, that, in one of them alone, a sum exceeding half-a-million sterling was, in the course of a century, expended by the proprietors. Their principal entrance is by an opening at the bottom of a hill, through a long passage hewn in the rock, leading to the lowest vein of coal. The greatest part of this descent is through spacious galleries, which continually intersect other galleries, all the coal being cut away, with the exception of large pillars, which, where the mine runs to a considerable depth, are nine feet in height, and about thirty-six feet square at the base. Such is the strength there required to support the ponderous roof.

The mines are sunk to the depth of 130 fathoms, and are extended under the sea, to places where there is above them sufficient depth of water for ships of large burden. These are the deepest coal mines which have ever been wrought; and perhaps the mines have not, in any other part of the globe, penetrated to so great a depth beneath the surface of the sea; the very deep mines in Hungary, Peru, and elsewhere, being situated in mountainous countries, where the surface of the earth is elevated to a great height above the level of the sea.

In these mines there are three strata of coal, which lie at a considerable distance, one above the other, and are made to communicate by pits, but the vein is not always continued in the same regularly inclined plane, the miners frequently meeting with hard rock, by which their farther progress is interrupted. At such places there seem to have been breaks in the earth, from the surface downward, one portion appearing to have sunk down, while the adjoining part has preserved its ancient situation. In some of these places the earth has sunk twenty fathoms, and even more, while, in others, the depression has been less than one fathom. These breaks the miners call dykes; and, when they reach one of them, their first care is to discover whether the strata in the adjoining part are higher or lower than in the part where they had been working, or, according to their own phrase, whether the coal be cast down or cast up. In the former case they sink a pit; but, if it be cast up to any considerable height, they are frequently obliged, with great labour and expense, to carry forward a level or long gallery, through the rock, until they again reach the strata of coal.

The total annual consumption of pit coal in England is stated to be 23,669,400 tons. A ton is about a cubic yard; and, taking one yard in thickness as the basis of calculation, it will give 305 yards per square mile of annual supply. And, supposing the coal to extend throughout the whole subsurface of the country, then the whole quantity would be exhausted in about 10,000 years. But recent observations in some of the Staffordshire mines have shown, that where some of them have been worked out, the workmen have only to work lower, and they find stratum below stratum, beyond all conjecture where they will stop. Thus we might furnish all the world for a thousand years with coals without fear of exhaustion.—*Shaw's Nature Displayed.*

MISCELLANEA.

Invention for Propelling Steam-vessels.—On Wednesday last the Lord Mayor made an excursion on the river, to witness the effect of Mr. Taylor's invention for propelling steam-vessels. The little steamer *Jane*, in which his lordship embarked, is the property of Mr. George Blexland, late engineer to the Commercial Steam-packet Company, and has been an object of admiration, on account of her diminutive size, being only a common whaling-boat, to which Mr. B., some months back, applied paddle-wheels, and in which he fixed a steam-engine of rather less than one-horse power. These paddle-wheels, with their cumbrous and weighty appendages, the paddle-boxes, have been removed, so that the little boat is restored to her original form, except the addition of a figure-head and counter-stern. The propeller, which has increased her speed one-third, the power remaining the same, has been introduced, but the steam-engine has not been moved from its original position; a fact that proved to the experimenters the entire applicability of the method to every steam-vessel. Throughout the whole of the trip, the *Jane* performed admirably. She was under the most perfect control, and appeared to be steered much more easily than when encumbered with the paddle-wheels. She moved as if by magic, creating no swell in the water, and was not affected by the hubbub occasioned by the rapid transit of the large steamers.

Resemblance in the Structure and Functions of Animals and Vegetables.—Plants are organized bodies, the ligneous or woody parts of which correspond to the bones of animals, since, like them, they are composed of concentric layers of hardened fibres, and of vessels to be separated by maceration. The pith answers to the brain and spinal marrow, and an apparent nerve runs down the middle of every leaf, sending off branches which ramify over its surface. They have also their vascular system like animals, and most of them a regular respiratory apparatus, corresponding to lungs. That they have likewise secreting organs and excretory vessels, is obvious from the various odours which they exhale. A tree has its cutis, cuticle, and cellular membrane; the leaves consist of an upper and lower surface of fine skin, between which a certain kind of pulpy substance is enclosed, and numerous air-bladders dispersed. Several are profusely covered with downy hair; and, in others, prickles supply the place of teeth. Grasses present a structure similar to what we see in leeches, caterpillars, &c., or, as having their densest part outside, in the lobster; and analogous in composition to the medusa and the soft insect, is the pulpy house-leek and mushroom. When the pith is dried up, the plant ceases to vegetate; it being of the same importance, and analogous in composition to the brain and spinal marrow of animals. In animals, the bile, saliva, and other fluids, are prepared and separated from the blood from the action of particular vessels; and in plants, a variety of juices are produced by similar operations. Some plants are said to throw off more moisture in a given time by perspiration than the human body. This fluid passes off through vessels which open upon the leaves; consequently it is a very extensive surface that is presented for the discharge of superfluous moisture. Plants also perspire, but in a slight degree, through the cuticular pores; and the same occurs in animals, less being thrown off by the skin than by the lungs. In animals, the colour of the skin depends upon the *rete mucosum*—a kind of net-work above the true skin—and the same appears to be the case in plants. Thus we see an obvious resemblance in the general structure and functions of animals and vegetables, differing, of course, in the more perfect and the more simple; yet, whatever deviations are found from the standard of perfection in the one, similar peculiarities occur in the other. The corresponding parts in each are destined to perform the same offices, or to answer the same purposes.

Sleep of Plants.—Towards evening, plants are known to fold up their leaves, and so continue in that state until morning, when they again expand. This presumed sleep of plants has been supposed by some persons to be owing to the absence of the heat of the sun, which causes a drooping of the leaves of vegetables. But plants kept in a hot room, where the heat is uniform day and night, contract their leaves in the same manner as those exposed to the open day. The same is observed in the lightest nights, and also in plants confined in rooms brilliantly illuminated during night. All plants during sleep dispose their leaves so as to give the best protection to the young stems, flowers, and fruits. The leaves of the tamarind fold round the fruit; the leaves of the chickweed and others, which are placed upon the stalk in opposite pairs, rise perpendicularly during night, and join so closely at the top as to conceal the flowers. The flowers of some plants, also, alter their position during the night; some enclosing themselves in their calyces, or shutting, as it is commonly called; and others hanging their heads towards the earth; but all resume their original position in the daytime.

Mountains.—Although the earth at the distance of Venus, or even at the smaller distance of the moon, would appear to be a perfect sphere, yet those bodies, when examined with a telescope, like the earth, exhibit great inequalities. Nevertheless, in such a mass as the earth, the mountains subtract less from its spherical figure, than the roughness on the rind of an orange subtracts from its sphericity. For although few mountains on the earth are four miles high, that elevation is but the 2000th part of the diameter; and the roughnesses on an orange being taken at the 100th part of an inch, and the orange at three inches, those roughnesses are the 300th part of the diameter, and, in proportion, six times greater with reference to the whole orange, than the highest ridge of mountains is with reference to the earth. Such being the case in regard to the ridges of the Himalayas in Thibet, and the Andes in South America, the Alps, the Pyrenees, and the mountains of Scotland and Wales, sink into comparative insignificance.—*Shaw's Nature Displayed.*

Sugar.—The art of refining sugar was discovered by a Venetian in 1503, who is said to have realized 100,000 crowns by the invention. Our ancestors made use of it as it came in juice from the canes, but most commonly used honey in preference.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, September, 23, Rev. Robert Vaughan, on the Crusades, their Origin, History, and Influence. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street. — Thursday, Sept. 24, Robert H. Schomberg, Esq., on the Customs and Manners of the Aborigines of Guiana. At half-past Eight.

Tower Hamlets Chemical and Philosophical Society, 236, High Street, Shoreditch.—Wednesday, Sept. 23, Quarterly Meeting. At eight o'clock.

Franklin Mutual Instruction Society, Halfmoon Alley, Lower Whitecross Street.—Monday, September 21, Rev. W. Vidler, on Astronomy. At half-past eight o'clock.

QUERIES.

By what means iron nails may be permanently coloured crimson, brown, blue, green, and yellow? G. BLANCHARD.

How to make a good black dye?

ANSWERS TO QUERIES.

To take off instantly a Copy from a Print or Picture.—Make a water of soap and alum, with which wet a cloth or paper; lay it either on a print or picture, and pass it once under a rolling-press, and you will have a very fine copy of whatever you shall have laid it upon.

Blue Ink.—Ferrocyanide of iron, with a little gum-arabic, will, I think, answer his purpose.

To make Essence of Peppermint.—Put any quantity of the fresh herb of common peppermint (mentha piperitæ) into an alembic; add of water as much as will cover it; then let the oil distil into a large cold vessel. This is a translation from the Pharmacopœia.

To Stain the Hair of an Auburn Colour, use muriate of gold.

Water produced by Burning Alcohol.—Let the flame of a spirit-lamp be placed under a vertical pipe, which is connected with a condensing worm. The product of the combustion, when drawn off from the bottom of the worm, is pure water. MANIPULATOR.

Soda-Water Powders.—Take six drachms of carbonate of soda, divide it into twelve equal parts, and put each into a blue paper. Divide five drachms of tartaric acid into twelve equal parts, and put into white paper. Dissolve each in half a tumbler of water; pour one to the other, and drink immediately. W. G. A. H.

French Polishing.—The process of using French polish having been already explained in No. 118, Vol. III., of this work, it would be needless for me to make a repetition of the same words; the only difference is, that French polishers use a little linseed oil, by dipping the end of their finger in the oil, and putting it on the linen rag previous to applying the polish. The fault which "Experimental Mechanic" complains of, certainly must be in applying the polish. Perhaps he continues to rub the work after the rag has got dry, which will remove the polish again. This, perhaps, might account for it appearing dull in the middle, while the edges remain polished; the middle being rubbed most, will remove the polish, as I have before stated. The rags used must be quite clean and free from lint. The work also must be very smooth, &c.; but to point out precisely where the fault is, would be impossible, without seeing it applied. And it cannot be expected that a person not accustomed to polishing can, with a first attempt, produce a polish equal to a person that is always at it; for, like many other things, it requires practice to make perfect. W. G. A. H.

TO CORRESPONDENTS.

S. P. *proposes the following query:—"When I look at the sun through a coloured glass at twelve o'clock, it being at this time* nearest *to me during the twenty-four hours, it appears to have a certain diameter; if at about seven or eight o'clock in the evening I again look at it, when it is just at the edge of the horizon, and, consequently, farthest from me, it appears to have a diameter three or four times as large; what is the cause of this, as* all other *objects appear* smaller *in the distance?" Neither optics nor astronomy can positively explain a phenomenon which depends solely upon an operation of the mind. That the sun or moon in the horizon suggests an idea of greater magnitude than the same body in its meridian, is undeniable; but it is also certain, that the real visual diameter is not increased, which may easily be proved, by observing the body through a tube, or by comparing its apparent diameter with an object at any fixed distance from the eye. Since it is clearly proved that the image, formed in the eye by a body in the horizon, is no greater than that formed by the same body in the zenith, it follows that the phenomenon must wholly depend upon a mental error or misapprehension. Various theories have been proposed by different philosophers, to explain the mystery; but most of them are so palpably erroneous, that they are not worth refuting. The theory which is now adopted by most astronomers, is the only one which has hitherto proved unanswerable; but it must still be considered rather as a highly probable conjecture, than as an established fact. It is assumed, that when we view the heavens from an open place, instead of appearing hemispherical, as they would be if formed by bodies of equal distance from the earth, we conceive them to be in a surface much flatter than half a sphere; so that the parts approaching the horizon, appear farther off, in the same manner as the distant parts of a flat ceiling suggest to the mind that they are farther off than the parts immediately over head. This being granted, all is explained; for the idea of magnitude depends upon the idea of distance, and the conceived magnitude must be proportional to the conceived distance.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by DOUDNEY & SCRYMGOUR (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

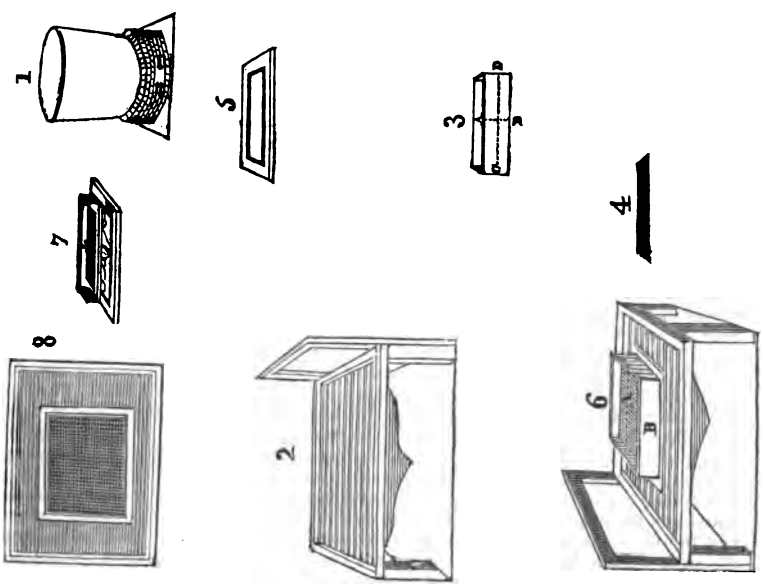
THE

MECHANIC AND CHEMIST.

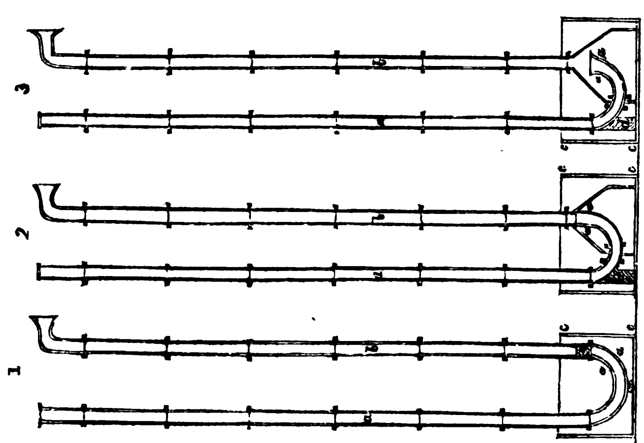
A MAGAZINE OF THE ARTS AND SCIENCES.

No. 112, NEW SERIES. | SATURDAY, SEPT. 26, 1840. PRICE ONE PENNY. | No. 233, OLD SERIES.

WERTHEIMER'S PATENT APPARATUS FOR PRODUCING RAISED SURFACES IN PAPER.



ADCOCK'S PATENT APPARATUS FOR RAISING WATER FROM MINES.



City Press, 1, Long Lane: Doudney and Scrymgour.

WERTHEIMER'S PATENT FOR PRODUCING ORNAMENTAL RAISED SURFACES IN PAPER.

(See Engraving, front page.)

(Abstract of Specification.)

ALL attempts hitherto to discover a means of imitating the reliefs of sculpture, by stamping or moulding, as I obtain by printing the lines and designs of painting, have proved fruitless. In fact, whether for the decoration of apartments to hangings, mouldings, the imitation of carved furniture and ornaments, or the artificial reproduction of works of art, it would be of great utility to fix the hollows and reliefs of sculpture on thin, flexible, light substances, capable of being stretched, folded, and applied to other bodies. For this purpose sheets of metal, leather, paper, pasteboard, stuffs prepared and united with clammy or gumming substances, have been successively employed. Among the substances, that which is best adapted to the exigencies of the work is unquestionably paper, used here as a generic term for all kinds of paper and pasteboard, whatever it may be composed of, as cotton rags, ligneous substances, &c. From its natural whiteness, its lightness, its flexibility, its cheapness, its solidity, its toughness, the facility with which it can be stretched and fixed with paste, paper, more than other material, would render usual and applicable this kind of veneering in relief; hence paper has been the object of numberless preparations for the purpose alluded to. I do not intend to write a history of all the fabrics of this kind, and will only state, that all the modes, more or less varied, of working the paper, may be ranged in two categories. In the former, the paper is in the state of a sheet; in the latter it is in the state of pulp. When the paper is worked in relief in the form of a sheet, whether it be dry or wet, and the work be done with heat or without, the difficulties that present themselves are insurmountable. In fact, placed between two moulds and forcibly compressed, the paper ought to give, to stretch, to cover the projections and line the depressions of the moulds. But manufactured paper, paper in sheets is, as one may say, non-elastic. The forced extension which is obtained, arises from the rupture of its tissue, whence it follows that all such parts as are angular, and a little projecting, are made thin, torn, cracked. Hence the absolute impossibility of copying, even imperfectly, large reliefs, and of obtaining anything beyond a sort of figuring or goffering (gaufrage). In the state of pulp more or less liquid, paper could not, up to this time, be cast in hollow forms or moulds, but by the addition of various substances. By the aid solely of these admixtures, I obtain smooth surfaces and correct reliefs; but this is an article of consumption which has no analogy with that, the advantages of which I have mentioned. It is a decoration (decor) only, and not paper in relief or embossed, it is breakable, heavy, thick; it is neither elastic nor flexible; it cannot be made to cover other bodies like a veneer; in a word, it does not realize any of the conditions of the problem. In the substance used for making the pulp-castings (known by the name of *papier maché*), cuttings of paper are reduced to pulp and mixed with size, Spanish white, powdered slate, and other substances. The pulp of paper, then, is here but a sort of canvass, containing and retaining in mutual connexion sundry materials, the admixture of which forms a mass lighter and less brittle than plaster, but which constitutes only the perfection of works of this kind. I pass over a third mode of employing paper in the fabrication of masks and dolls. The uniting sheets of paper or pasteboard in a mill by means of a cementing substance, has no analogy to the object in question; besides, even in this manufacture, the pasteboard is necessarily united with clammy substances, which are breakable when dry. Thus, then, that manufacturing problem remains unsolved, which consists in fixing the depressions and reliefs of sculpture on a thin flexible body, hard, light, elastic, and that will admit of being fitted and pasted to other bodies, for the purpose either of decorating apartments for hangings, mouldings, or fancy devices, or to imitate valuable carved furniture or ornaments, or to reproduce, at a low price, works of art of every kind.

It is the solution of this problem which has been discovered, and for which I have obtained her Majesty's letters patent. I beg to repeat, in order to distinguish that which is novel in the process more effectually.

First, that I do not employ paper, card, or pasteboard in sheets, except occasionally in an unfinished state.

Secondly, that I do not employ the pulp of paper cuttings, of rags, or any other analogous substance in the state of pulp, firm, and that will admit of being handled, as in the manufacture of dolls.

Thirdly, that I do not mix with the pulp of paper any of the materials employ-

ed in the fabrication of articles of *papier maché*; and that if I do occasionally make an addition, it is solely with the view of changing the colour or aspect of the work, and by no means to assist in moulding the pulp of paper, from which I obtain the better effects the purer it is.

Fourthly, finally, that I work with the pulp of paper cuttings, rags, or any other fibrous or ligneous substances in a liquid state, and in the same quantity as they are used in common paper-mills. Thus I make paper in relief of all sizes, as common paper is daily made in sheets and pieces with a smooth and plain surface. My process consists, then, in substituting for the wire moulds that are employed in common or mechanical mills, moulds carved in relief or concave. And as the liquid, which holds in suspension the fibrous particles of the diluted pulp, cannot run through the carved moulds as it does through those of wire, I, by a new method, precipitate these particles mechanically and regularly upon the carved surface, and separate them from the liquid; as I proceed to explain in the following description of the process and apparatus.

Description of the Apparatus used in the Manufacture of Embossed Paper.

In the manufacture of paper without machinery, the pounded rags are diluted to a proper degree in a vat, slightly heated, from which the workman takes, in a form or mould, the quantity of material necessary for the formation of each sheet of paper.

Fig. 1 represents this vat.

Fig. 2 represents a strong wooden table, composed of a certain number of parallel laths or blades, like those of a blind or shade (pesienne), with an interval of some lines between them. Under this table, a sort of apron, or large funnel of wood or zinc, is destined to receive the water that passes between the laths, and to conduct it to a receptacle fixed in the most convenient situation.

Fig. 3, a frame composed of four pieces of wood joined at the ends like a box. Its height measured on the line, A B, is six to eight inches; the thickness of the board is one inch on two of its sides, and, following the direction of the line, A B, holes are bored from six to nine lines in diameter, and six lines one above another. These holes are stopped by corks, which are easily withdrawn, to suffer the liquid that the frame may contain to escape. There must be a certain number of similar frames varying in length and breadth, according to the size of the moulds; as the edges of the latter must always exceed, by one inch, at least, the dimensions of these frames.

Fig. 4, sash-frames (chassis) of slight wood, or better of copper, the exterior length and breadth of which should be rather less than the exterior length and breadth of the frame, fig. 3, into which they must be inserted. These sashes are covered with cloth of silk or hair, which makes them represent a very elastic paper mould; this cloth can be likewise made of any other substance.

Fig. 5, a mould of carved wood, representing inverse the subjects to be worked in paper. These may be made of any material, provided they have sufficient strength to support a pressure frequently repeated between a hard body (the platform of the press) and an elastic body (the counterpart of felt and cloth shearings).

Fig. 6, table on which are represented the mould and the frame, in which the diluted material is to be poured; A, the mould; B, the frame.

Fig. 7, section of the same frame; the line, C D (fig. 3). The letter C marks the chassis or sash, which precipitates the solid matter upon the mould, M. The disengaged water, E, escapes at the orifices, O.

Fig. 8, plan of figs. 2 and 6. To this apparatus I must add the following articles, of which it is needless to give drawings, viz.:—

1st. The ordinary moulds of paper-makers.

2nd. Sponges of different sizes.

3rd. Brushes, hard pencils, scissors, knives, embossing tools of modellers, spatulas of wood, &c.

4th. Felts of different sizes.

5th. Presses of the power of 200,000 to 400,000 pounds, of any construction.

6th. Jugs and vessels of such sizes and forms as may be required.

7th. Shelves or frames to complete the drying of the work in stoves, or by the air, arranged as convenience will admit.

Process of Manufacture.—First Method.

A workman places on the table, fig. 2, the mould required; on this he places the frame, fig. 3, in the manner shown in fig. 6; he then takes out of the vat, fig. 1, by means of a vessel of sufficient capacity, the diluted pulp, with which he fills the frame to about one inch of the edge; he then stirs it with his hand, that it may spread itself uniformly over the surface of the mould. The only object now is, to precipitate the matter regularly upon this surface, and to make the water which holds it in suspension run off. For this

purpose the workman takes the sash or sieve, No. 4; he presses it down quite horizontally into the frame, as is shown in the section, fig. 7, and by this action carries down all the particles of solid matter; and the water, passing through the distended tissue upon the sieve, is thus disengaged. It is now only necessary to procure its egress, which is done by opening the holes bored in the sides of the frame. When the greater portion of the water has run off out of the frames, what remains is absorbed, by applying to the cloth of the sieve large sponges, which are there compressed, until the stuff has acquired a certain consistence, which is known by the cloth ceasing to adhere to it. The sieve is then removed, and afterwards the frame; and there remains upon the mould a regular layer of paper in process of manufacture, which covers it equally in the hollows and flat parts. With sponges of different sizes I continue to absorb the water, and to press the material chiefly into the hollows; and when satisfied that it touches everywhere, and is sufficiently dried, I prepare to put it to press. I fill the hollows carefully with shearings of cloth (tontures de draps), which are to be pressed in a little, and which are to be left a few lines higher than the flat portions of the mould. It is then placed on the bed of a powerful press, and covered with a layer of felts, the thickness of which must be proportioned to the depth of the carving, and pressed with the whole power of the machine. This operation imparts to the work all the consistence and tenacity requisite. The shearings of cloth are then removed from the cavities with small brushes. Every possible impression may be obtained by this method; you may even have ground patterns (des dessous).

(To be continued.)

ADCOCK'S PATENT FOR RAISING WATER FROM MINES AND OTHER DEEP PLACES.

(See Engraving, front page.)

(Abstract of Specification.)

By the present modes of raising water from mines and other deep places, by pumps and pump-rods, and other mechanical contrivances, the water is raised through a series of pipes, in a compact or solid state; in other words, if the depth through which the water be raised by one pump or one lift, be 100 feet, then the pipes, extending that depth, will be full of water, and the whole column of water in those pipes will be lifted up at one and the same time. A column of water 100 feet deep, presses with a force of about forty-five pounds on each square inch of its base. Hence, if the diameter of the pump-bucket or plunger, be twelve inches, and its area, as a consequence, 113 inches, the weight of water to be lifted by the pump or other mechanical contrivance, at each stroke, will be about 5085 pounds, British avoirdupois weight. In a deep mine, therefore, containing ten such columns or lifts of water, below one another, and acted on at the same time by the same pump-rod, extending down the shaft or pit of the mine, the weight of water to be raised is very great, being 50,850 pounds. Hence, to sustain such weight of water, and to overcome the friction of the water in the pipes, and the *vis inertiæ* to put such columns of water in motion, and to sustain its own weight, the pump-rod must be made of sufficient strength; and the steam-engine, water-wheel, or other prime mover by which the effect is produced, must be of large size and great power. By consequence of this *vis inertiæ*, the friction, and the great weight to be put in motion; and, when steam-engines are employed, the alternate action or reciprocation of the great lever or beam of the engine; the number of feet of effective strokes made per minute, is comparatively small, being generally, in deep mines, from about fifty to eighty feet. To explain this more fully, the whole mass of water in the ten columns, being equal in weight to one column of water of the same diameter, and 1000 feet in depth, may be considered as being lifted in the mass, through a distance of fifty or from that to eighty feet per minute. Now, by my improvements in raising water from mines and other deep places, or from a lower level to a higher, and which improvements are applicable to raising liquids generally, and to other purposes, I do not raise water or other liquids in the mass; nor do I find it necessary to exert a pressure, at one and the same time, of forty-five pounds per square inch, as hereinbefore stated, when the height to which water must be raised is 100 feet; nor do I raise water by pumps and pump-rods, but in the manner now to be described; that is to say—

By the aid of a steam-engine, water-wheel, or other prime mover, I give motion to a fan (such as is used, very commonly, by foundry men, engineers, mill-wrights, and others, to force a current of air into cupolas and other kinds of fur-

naces), or to the piston of a blowing cylinder (such as is used by iron masters and makers of iron to force a current of air into blast furnaces for the reduction of ores), and, by the aid of such fan or blowing cylinder, I condense atmospheric air, that it may have a tendency to escape into the atmosphere when liberated from its confinement, with a velocity due to its pressure. When atmospheric air is condensed to a quarter of a pound pressure per square inch beyond the atmospheric pressure, and is liberated from its confinement, it moves, or has a tendency so to do, at the rate of 173 feet in each second of time; at half-a-pound pressure per square inch, the speed due to the pressure is 245 feet per second; at three-quarters of a pound, 296 feet; at one pound, 340 feet; at a pound and a quarter, 375 feet; at a pound and a half, 410 feet; at a pound and three-quarters, 436 feet; at two pounds, 467 feet; at three pounds, 555 feet; at four pounds, 624 feet; and at other pressures with other velocities or rates of speed, as may be known by reference to, or consulting any of the treatises that have been published on the science of pneumatics. Now, instead of raising water in the mass, as hereinbefore described, by pumps and pump-rods and other mechanical contrivances, I avail myself of the mechanical effects to be obtained from the velocities of the air, as due to the pressures hereinbefore made known, or to any other pressures that circumstances connected with mines in different localities may prove to be desirable. I cause the water which must be raised from the mine, or from a lower level to a higher, to be dispersed and carried up in drops, like drops of rain; but the velocities of these drops upward, in consequence of the velocity of the air, as due to its pressure, as above described, is far greater than the descending velocities of rain; for drops of rain, when not receiving an impulse from winds, can only descend through the atmosphere with a speed of about eight feet in a second, when the diameter of each sphere or drop of rain is the hundredth part of an inch. When the diameter of the drop is the sixteenth part of an inch, the greatest descending velocity through the atmosphere is about seventeen feet in a second; and the velocities in a second through the atmosphere, for drops of rain of other diameters, may be thus stated:—For drops an eighth of an inch diameter, twenty-four feet; for drops three-sixteenths of an inch diameter, thirty feet; and for drops a quarter of an inch diameter, thirty-four feet per second. Whereas the velocity of the air, when allowed to escape from a pipe upward, at one pound pressure per square inch beyond the atmosphere, and without making any deductions for the friction against the sides of the pipe, is about 340 feet in a second. But it should be stated, when the air is commingled with the water that must be carried up by it from a mine, or from a lower level to a higher, its motion to a certain extent is retarded. The velocity of the drops of water, however, upward, by this mode or these modes of raising water from mines and other deep places, is far greater than the velocities at which rain usually falls; as hereinbefore has been described.

Description of Engravings.

In the engravings, figs. 1, 2, and 3, represent three different kinds of apparatus for carrying my aforesaid invention into effect; and in each figure the same letters of reference denote contrivances to accomplish similar objects. The three kinds of apparatus delineated in the engravings, are shown in section; *a a*, *a a*, *a a*, *a a*, represent a pipe made of zinc, iron, or other material, to convey air from the fan or blowing cylinder aforesaid, down the shaft of the mine, or to any other depth from which the water or other liquid must be raised; *b b*, *b b*, *b b*, another pipe, somewhat larger than the other, to convey the air aforesaid, and the water which is carried up by it from the mine or other depth, in drops to the surface of the earth, or to the adit, or to any required height, or place of discharge; *c*, *c*, *c*, *c*, a chamber or reservoir, from which the water or other liquid must be raised. By the rapid revolution of the fan, or the upward and downward motion of the piston in the blowing cylinder by the steam-engine, water-wheel, or other prime mover imparting motion to it, atmospheric air of the requisite amount of pressure is made to flow down the pipe, *a a*, *a a*, *a a*, *a a*; and where the pipe turns upwards in the chamber or reservoir, *c*, *c*, *c*, *c*, aforesaid, it comes in contact with the water or other liquid, disperses it into drops and forces it up the pipe, *b b*, *b b*, *b b*, and delivers it at the top. In fig. 1, a series of apertures is represented near the bottom part of the pipe, *b b*, *b b*, *b b*; it is through these apertures that water or other liquid flows into the pipe in a series of jets, and is dispersed and carried up the pipe by the ascending stream of air. In figs. 2 and 3, the pipes, *b b*, *b b*, *b b*, terminate in chambers, compounded in shape of a cone and cylinder, and the cylindrical part of each chamber

near the bottom is perforated with a series of apertures, through which the water or other liquid flows from the reservoir or chamber, *c*, *c*, *c*, *c*; into it. The water ascends above the termination of the air-pipe, *a a*; it is there met by the ascending current or stream of air; it is dispersed into drops, and carried up by it in the manner hereinbefore described. In mines and other deep places where the water may accumulate, and rise to some height in the pit or shaft from the stoppage, either by accident or otherwise, of the steam-engine, water-wheel, or other prime mover, or from other causes, introduce a stop-cock or other contrivance, adapted to the purpose, to regulate the admission of water into the pipe, *b b*, *b b*, *b b*, instead of allowing it to flow freely into it through the apertures herein described. I secure to this stop-cock or other contrivance, a rod of wood or metal sufficiently long to be above the surface of any water that may accumulate in the shaft or pit, and of sufficient strength to enable the workmen to open and shut the aperture of the stop-cock or other contrivance by it. It is essentially necessary that this should be attended to, or otherwise the water or other liquid may accumulate to such a height in the pipes, *a a*, *b b*, as may prevent the passage of the condensed air from the pipe, *a a*, into the pipe, *b b*, and thereby stop the action of the apparatus. For a similar reason, the water or other liquid should never be allowed to stand at a higher level above the bottom of the pipe, *a a*, *a a*, *a a*, *a a*, than the pressure of the condensed air can displace. To effect this, the reservoir, *c*, *c*, *c*, *c*, must be so proportioned to the lower part of the pipe, *b b*, *b b*, *b b*, that whatever number of inches the water or other liquid may descend by the pressure of the air in the one, it will ascend to an equal number of inches in the other, as in the two limbs of a siphon or bent guage.

In other modes of applying my invention in practice, I cause the water or other liquid to flow into the apparatus, in any given time, in direct proportion to the quantity that must be carried up by it in that time; and, in other modes, I cause the air to be dispersed and distributed under a large surface of water in a confined reservoir or chamber, that it may take up the water by adhesion, in the same manner that water is taken up in the formation of steam; excepting that, in the one case, the water is taken up by the air, in the other, by caloric. The water and air commixed, is then allowed to accumulate above the surface of the solid water confined within the reservoir or chamber aforesaid, assimilating in its object to a boiler for the generation of steam, until it attains the same pressure per square inch, as the air contained in the pipe, *a a*. It is then allowed to flow through a pipe, extending above the surface of the water or other liquid in such chamber, into the chamber at the lower part of the pipe, *b b*, *b b*, *b b*, where it meets with, disperses in drops, and carries up, a farther quantity of water, in the manner hereinbefore described.

At the top of the pipe, *b b*, I cause the air and water to be received in a dome, or other appropriate chamber, that the greatest portion of the water may be collected together again in a body, and thence be allowed to flow freely away; the air, and such portion of water still retained by it, are also allowed to escape.

The fan or blowing cylinder, as the one or the other be employed, may be made to receive air from the open atmosphere; or it may be allowed to receive it from the depths of the mine, by means of pipes extending to the required distance. By this mode of operation, pure atmospheric air will descend the pit or shaft of the mine by its gravity, to occupy the space from which the impure air has been withdrawn; and thus the ventilation of the mine or other place may be either wholly or partially effected.

In other modes of raising water by my improvements, as aforesaid, I produce and maintain by any of the mechanical means adapted to the end, a partial vacuum in the pipe, *b b*, *b b*, *b b*; and, instead of having a pipe, *a a*, *a a*, *a a*, *a a*, extending to the surface of the earth, allow air to flow from the mine into it, through other pipes, arranged for that purpose; so that, by the difference of pressure between the air in the mine and that in the pipe, *b b*, the water may be carried up, in drops, in the manner hereinbefore described.

FOUR-WHEEL AND SIX-WHEEL RAILWAY ENGINES.

A CONTROVERSY has lately sprung up amongst engineers, concerning the respective merits of four-wheel and six-wheel engines; and, considering everything connected with this branch of mechanism of the highest importance, not only to the engineer and the amateur mechanic, but, in its ultimate operation, to the entire population of this country, we lay before our readers some of the chief arguments advanced on either side. Mr. Edward Bury, a respectable authority in

questions of this nature, prefers four wheel engines, and gives nine reasons for preferring them to engines on six wheels:

"1stly. The engine on four wheels is less costly than the one on six wheels; therefore, to have the same number of engines, or the same power on a line of railway, less outlay of capital is required.

2ndly. It allows the engine to be got into less space; consequently more compact, firmer, less likely to derangement, and much lighter.

3rdly. Though the engine is lighter, the adhesion is more perfect, from the weight on the driving wheels remaining uniform, however unequal or out of level the rails may be, enabling the maker to equalise the strain and adhesive power at the same time; as it is lighter, there is less power required to take it up the inclines, therefore more available power left to take up the train.

4thly. The engine is safer, as it adapts itself better to the rails, not being so likely to run off the line at curves or crossings.

5thly. It is more economical in the working, as there is less expense of interest and of depreciation; fewer parts in motion, and, consequently, less friction or wear and tear, as there are fewer parts to maintain.

6thly. The engine being more simple in its construction, in addition to the advantage of having fewer parts in motion, those which are more easily got at, therefore much less expense is incurred in those repairs which are common to both plans.

7thly. The buildings, turn-tables, and other costly conveniences necessary for the maintenance and repair of the engines, are not on so large and extensive a scale; as the engine on four wheels occupies much less space than the one on six wheels.

8thly. As there are fewer parts to maintain on the four-wheeled engine, fewer tools, such as lathes, drills, smithies, &c., are required for the repairs of the one engine than the other.

9thly. As the engine is more simple, having fewer parts likely to derangement, there are fewer chances of delays or stoppages during the journeys, or the times of taking the trains."

In reply to the foregoing, we extract the following judicious remarks from a correspondent of the *Railway Times*:—

"Although each manufacturer has his own peculiar arrangement, I am not aware of any essential difference of necessity involved in the distinction between a four-wheeled and a six-wheeled engine, excepting what the name implies, that one has *four wheels* and the other *six*.

A practical example of this may be seen on the Greenwich Railway, among others, where a pair of wheels has been introduced under the fire-box of an engine, which, I am informed, has run much better since the change, although unaltered in every other respect.

The six-wheeled engine does not require more complicated or additional working machinery; therefore, excepting the allowance to be made for the trifling additional friction and weight of one pair of wheels, &c., *Reasons* 2, 5, 6, 8, and 9, must be allowed to fall to the ground.

In answer to *Reason* 3, I think that most engineers will agree with me, that the adhesion is more perfect in the six-wheeled engine, or, at least, equally so. It is the custom, by tightening up the springs, to throw considerably more weight on the driving wheels than on the others, by which arrangement the driving wheels readily spring down and accommodate themselves to any inequality in the rails; and as the additional weight of one pair of wheels bears but a small proportion to the gross weight of an engine, the power lost in moving them is inconsiderable.

It is strange that *Reason* 4 should have found its way to the wrong side of the argument. The additional pair of wheels tends, I conceive, greatly to diminish that lateral rocking motion, so common to railway trains, and the frequent cause of the four-wheeled engine running off at curves and crossings. By allowing a slight play in the brasses, a six-wheeled engine will traverse curvesas easily as, and much more safely than a four-wheeled.,

Reasons 1 and 7 alone I shall leave uncontested (although the above arguments will probably weaken their force); and allow me, sir, in reply to them, to offer one or two reasons in favour of a six-wheeled engine.

I believe I am right in stating, that the third pair of wheels under the fire-box, was added at first to equalise the weight on the rails, and to correct the pitching, which was observed to an alarming extent in the engines with four wheels. Any one, who will take the trouble, may see, that while the motion of a six-wheeled engine is comparatively steady, that a four-wheeled engine is attended with constant jumps, and that the slightest obstruction throws the leading wheels up from the rail, on which they fall again with considerable force. This pitching added to the rocking, to which I have alluded, is productive of several very serious results.

1st. The destruction of the permanent

way; for no road, however well laid, can withstand the force of the engine continually leaping upon it, without rapid deterioration. 2nd. The same cause obviously tends to increased wear and tear of the machinery, one of the heaviest expenses attending the working of a railway; and, from the increased liability to derangement, there is much greater chance of the detention of the train on the road. 3rd. There is a still more alarming consequence,—namely, danger to the public. Four-wheeled engines, when moving at high velocities, have been known to jump completely off the rails, and carry the train with them, when no cause could be found for the accident, in the derangement of the rails or engine.

The breaking of an axle in the four-wheeled engine must, almost inevitably, be attended with the overturn of the engine and train, an accident to which a six-wheeled engine is not so liable, from the shocks to the axles not being so great; and which, if it did occur, would not necessarily produce the same frightful results, as a considerable portion of the weight would be supported by the other four wheels.

To the above practical reasons for preferring the six-wheeled engine, I will only add one, derived from the testimony of those who are best qualified to give an opinion. Most of the leading engineers of the day, and especially the Messrs. Stephenson, gentlemen whom all will allow to take the lead in railway experience and skill, prefer the six-wheeled engine, as *safer and better in every respect.*"

We again call the attention of engineers to our remarks on railway curves in No. 37, N. S. We not only think, but are quite certain, that much greater security and diminution of friction would be obtained by a proper attention to the construction there described.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, September 30, James Tennant, Esq., on Marbles and Building Stones. Friday, Oct. 2, H. H. B. Paull, Esq., on the Works of Milton, with Illustrations, At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street. — Thursday, Oct. 1, H. Hersee, Esq., on Elocution. At half-past Eight.

Franklin Mutual Instruction Society, Half-moon Alley, Lower Whitecross Street.—Monday, September 28, Rev. W. Vidler, on Astronomy. At half-past eight o'clock.

QUERIES.

What is the best test for lime in water; and how much lime will it take to saturate water? Likewise the best test for carbonic acid gas in a very strong solution of crystal soda, or a solution of crystal soda and lime? SOAP-MAKER.

ANSWERS TO QUERIES.

To Clean Kid Gloves.—The most efficient method I have ever experienced is, first putting on the glove, and then, with a piece of flannel, wipe it over with milk and soap. This will effectually remove all dirt, but not stains, and is unaccompanied with any unpleasant smell.

N. H. RIVERS.

To Polish the Horns of a Buffalo.—The best method is to have them buffed, the same as the comb-makers buff their combs, by lathe or steam power. The cheapest method of mounting them, is the method employed by the white-metal smiths. I have a pair of horns I intend to polish myself. After taking the ruff off with a file, and rendering them tolerably smooth, I scrape them with a piece of steel or knife, ground similar to a carpenter's scraper. A little pumice stone and oil will fetch out the marks of the scraper; I then polish them with oil and rotten-stone, on a piece of wash-leather, and finish them off with the palm of the hand. The hand, especially that of a female, is one of the best substances that can be used for polishing. J. CHILD.

TO CORRESPONDENTS.

Mr. Hedgecock.—*We have received a letter for him, which shall be forwarded, if he will send us his address.*

J. B. Smith.—*We have inquired of manufacturers and others, but it does not appear that any method is known to restore velvet when soiled with grease, &c. The spots may be removed by any ordinary process; but the pile cannot be restored after being laid by grease, &c.*

A Correspondent.—*The professors of chemistry at our principal institutions are the following:—*
University of Oxford—C. G. B. Daubeny, M. D.
Cambridge—J. Cummins, M.A., F.R.S.
London—Professor Daniel, F.R.S.
Edinburgh—T. C. Hope, M.D.
Aberdeen—T. Clark, M.D.
St. Andrews—T. Thomson, M.D.
Trinity College, Dublin—F. Barker, M.D.
College of Physicians, Dublin, E. Davy.

A. B.—*The small steamer on the Thames, the "Jane," is moved by Taylor's propeller. It is placed at the stern of the vessel, and acts on the principle of the spiral worm, the paddles being segments thereof.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by DOUDNEY & SCRYMGOUR (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 113, NEW SERIES. | SATURDAY, OCT. 3, 1840. PRICE ONE PENNY. | No. 234, OLD SERIES.

WILSON'S PATENT IMPROVED PAPER-CUTTING MACHINE.

FIG. 1.

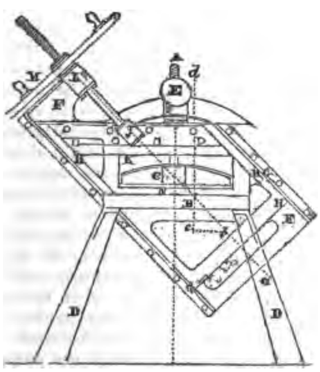
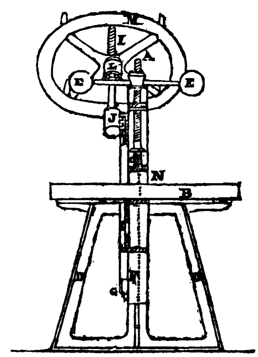
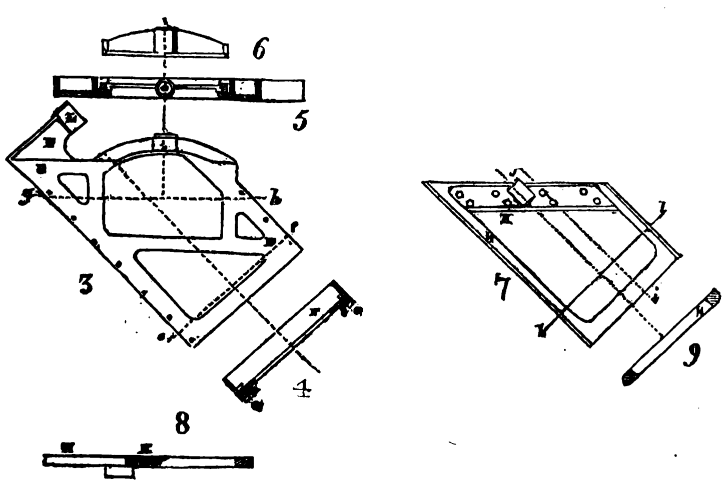


FIG. 2.





City Press, 1, Long Lane: Doudney and Scrymgour.

WILSON'S PATENT IMPROVED PAPER-CUTTING MACHINE.

(Abstract of Specification.)

Description of the Drawings.

In the drawing marked No. 1, fig. 1 is a front elevation.

Fig. 2, a side view, with parts removed for better elucidation, showing a section taken on the line, *a b c d*, in fig. 1; and, in order more clearly to be understood, I will premise, that those parts of the paper, which in this machine be uppermost and undermost in the press, I call the surface of the paper, while the substance through, from the said upper to the said under surface, I call the body of the paper. In drawing No. I, fig. 1 represents a press for holding the paper firmly during the operation of cutting, A being the screw; B, the bed or table; C, the press follower; D, the legs or supporting frame-work; and E, the ball or fly-lever of the nut, working in the socket coloured yellow, by which the screw, A, is moved; F F F is a frame cast in one piece with the press (as better shown in fig. 3, drawing No. 2.) This frame has a sliding groove at each side, formed by pieces, G G, screwed on to the sides, as shown in section at fig. 4, drawing No. 2, which is supposed to be taken on the line, *e f*, fig. 3. In these grooves slides an inner frame, H H H, which I call the sliding frame; this frame slides easily up and down the grooves, G G. The upper end of this inner or sliding frame, holds the cutting blade or knife, K, which, it will be seen, is a simple straight blade of steel, with a cutting edge shaped like a chisel, the flat side being next to the press; I is a screw, keyed at J on to the frame holding the cutting blade, K, and working through a fixed head, L, and made to move up and down by the revolutions one way or the other, of the fly and handled wheel, M. The effect of this arrangement will be, that paper being put into the press, as at N, and properly screwed down, with that portion which is to be cut off, projecting under the cutting blade, K; if the wheel. M, with its nut, and socket coloured yellowed, is turned round, the cutting blade will be forced downwards, towards the lower end of the outer frame, F F F, moving sideways, across the surface of the paper in the press at N, and, at the same time, forcing its way diagonally through the body of the paper, till the whole of the portion required to be removed, has been cut through; when, by reversing the motion of the wheel. M, the cutting blade will be drawn up again to its former position, ready for a second cutting operation.

Fig. 5, drawing No. 2, is a cross section of the frame, F F F, on the line, *g h*, showing the press follower, with the guides for the same.

Fig. 6 is an elevation of the press follower.

Fig. 7 is a front elevation of the inner or sliding frame, H H H, containing the knife or cutting blade.

Fig. 8 is a section of the same, on the line, *i j*, showing the blade, fixed to the head of the frame by bolts and nuts; and

Fig. 9 is a cross section of the frame, H H H, on the line, *k l*; and similar letters being used to denote similar parts in all the figures, no farther description will be necessary. Now, whereas it is evident, that the relative positions of the cutting blade to the frame, or of the frame to the paper, and the consequent double action of the cutting blade may be effected in various ways, and, either with a paper placed in the press (as shown at N in the drawing No. 1), or at any suitable angle, to meet any other arrangement of the cutting blade, which may thus be made, so as to be forced by a screw, acting vertically, downwards or upwards, or sideways, or at an angle, as represented in the drawings. And various other means, such as a lever with creeping pauls, or many other contrivances, may be used to force the cutting blade through the paper.

WERTHEIMER'S PATENT FOR PRODUCING ORNAMENTAL RAISED SURFACES IN PAPER.

(Concluded from page 180.)

Second Method.

When the subjects to be reproduced in paper are not in very high relief, but which, however, could not be worked by means at present known, and especially when they are softened down, so that the edges are lost in the ground, I can operate in the following manner:—The workman plunges into the vat a common paper mould; he withdraws it, lets it drain, and places on the felt (feutre) the unfinished sheet of paper, as is done in making paper without machinery. He lightly presses on this sheet a second felt, which absorbs the excess of water that it contains, and he stops when it has acquired the consistence requisite to support itself: it must not be put to press. A second workman then carefully lifts it up and applies it to the mould, into the hollow of which he is

careful to make it enter by means of sponges, or by striking it with brushes of different sizes; for the work has not yet acquired the tenacity which is imparted to it by pressing and drying. If there should be any fractures, they may be covered by applying to them a morsel of the same sheet, or of another in the same stage. As many sheets are thus placed in succession as may be deemed requisite side by side, taking care to make the edges meet, or one upon another, according as you wish to obtain a surface of greater or smaller extent and thickness. The precautions used in submitting the work to the action of the press, are the same as those employed in the first method.

Third Method.

Instead of taking up the pulp from the vat in a vase or paper mould, as mentioned in the first and second methods, the workman dips a sieve into the vat, which he shakes slightly, in order that the pulp, in draining, may form a homogeneous mass; and, before it is completely drained—that is, when it has acquired only so much consistency as to admit of its being lifted in parts by the hand—the workman takes a piece of it, sliding his hand between the bottom of the sieve and the mass of pulp that covers it, and taking care not to disturb the amalgamation of the component parts. He removes this fragment to the mould, and lays it out by beating it lightly and quickly with a brush, the hairs of which are very much divided and very elastic. In this manner the pulp distends like a malleable body, and the hairs of the brush will separate regularly the fibrous particles, which is always an indispensable condition to obtain a good result. The first fragment being finished, the workman takes a second in the same manner; then a third, and so on, which he spreads successively with the brush side by side, taking care that the edges unite and amalgamate completely. He thus continues until the mould is entirely covered, and the hollows filled up. Over the whole he then places a cloth of silk, hair, or other material sufficiently elastic, and sponges the whole surface, continuing the operation as explained in the first and second methods.

General Observations.

It is with sheets half formed, as before stated, that accidents happening in the first method are to be repaired. It is with sheets in the same stage, that I can reload or augment the thickness of the specimens that I desire to have stouter. For these linings or additions, a pulp of inferior quality is used. To insure the most complete success in these operations, it is essential to size the pulp beforehand; therefore the moulds must be slightly oiled. It is well to let every specimen dry on the mould; it then comes off perfectly straight and clean. The drying goes on rapidly enough in summer in the open air, and in winter in a stove, with a stream of hot and dry air. By tinting the pulp beforehand, with such colours as are employed for threads and cottons, I can obtain a great variety of colours and tones. If black or coloured printing inks be applied to the flat parts of the mould by means of a roller or dabber (rubber), these inks will attach themselves to the ground of the work, and you will obtain two colours by a single operation. These effects may be multiplied, by employing precisely similar means to those that are in use for this kind of printing; in short, paper, on account of its whiteness, is better suited than any other material whatever, to receive all kinds of tints and hues, and that in distemper, varnish, or oil, when properly sized for the purpose. To preserve the reliefs, which an infinity of causes will tend to deface, I reserve to myself to fill the cavities of my papers with various substances, capable of being accurately moulded into them. The specimens prepared in this manner will offer superior advantages for decoration. The tendency of paper to imbibe moisture, being likely to become a cause of deterioration to articles prepared by my process, I also reserve to myself to saturate or cover with resinous or oily liquids, as varnish, &c., the material which I employ.

DESCRIPTION OF ELECTROTYPE.

(*Continued from page* 156.)

On the Management of the Apparatus.

Next to electro-magnetism, there is no branch of science that requires more dexterous manipulation than voltaic or electro-chemistry; the most trifling film of oxydation often retarding the action of the most powerful apparatus. But, in the present instance, slow action and simplicity of arrangement being the predominating features, such nice attention to minutiæ is not absolutely necessary, or, at least, not so much so as to deter those hitherto unacquainted with the subject from practising. In all cases, to insure a metallic connexion, binding screws are preferable to cups of mercury; but, in

using them, the copper wire, where the attachment is made, must be brightened with a piece of emery paper; also the point of the screw, where it presses on the wire. In soldering the wires to the plates, let as little resin be used as possible: sal-ammoniac or dilute muriatic acid answers the purpose much better. In these experiments, I have invariably found an equal-sized piece of zinc to answer best. In the construction of galvanic batteries in general, I am aware this is a mooted point with high authority; but my own practice, which has been by no means small, with batteries of every construction, has led me to the opinion that, wherever slow and equable action is required, the positive and negative electrodes should be of equal superficial area. Although amalgamated zinc plates are preferable when combined intensity and continuity of action are required, they must not be used, under any circumstances, for the present purposes. It will likewise be found to be essential, that the thickness of the zinc be equal to that of the required deposition. Let the porous bottom of the interior vessel containing the zinc, be a little larger than either of the electrodes. I have hitherto used for this purpose, either bottomless glass cylinders or wooden boxes varnished, with plaster bottoms; but I should recommend a well-glazed earthenware vessel, having no bottom, but a slight rim projecting inwards, to secure the plaster. The zinc should be occasionally taken out of arrangement during the continuance of the process, and cleansed by washing it in water: the saline solution may also be renewed. Crystals of sulphate of copper should be added, from time to time, to the cupreous solution; but should the deposition require to be thick and long-continued, it will be necessary to take out the cupreous solution once or twice during the operation, and add an entirely fresh one; as the sulphuric acid necessarily set free after the deoxidizement of the copper, when it predominates to any extent, prevents the required action from taking place on the copper; instead of which, a sub or a de-oxide of copper is deposited in the form of a reddish-brown powder, the solution being rendered colourless. When this takes place, the plate should be taken out, and well washed in very dilute nitric acid. I have tried several methods to take up a sulphuric acid as it was set free: pure clay answers this purpose very well; the acid combining to a certain extent with it, and forming a sulphate of alumina or alum at the bottom of the vessel. When the voltaic copper is bent, it breaks at a similar angle to cast copper; but, when heated to a red heat, and slowly cooled, it assumes somewhat of the pliability of rolled sheet copper, requiring to be bent several times before breaking; should it now be beaten on an anvil, it will assume its brittleness. It may be filed, polished, and cut with shears in the usual manner; the surface acquiring as fine a polish as the copper in use among engravers. Should a thick mass of metal be requisite for any practical purpose, as it would require a considerable lapse of time before it could be obtained by the voltaic process, the back of the deposited metal may be thickened or filled up with solder in a manner already practised in the arts, without the slightest injury to the surface or texture of the deposited metal.

I have now finished all that the inventer, Mr. Spencer, has communicated. The following is taken from Mr. Sturgeon's work, "Annals of Electricity:"—In our conversation on the subject of taking fac-simile impressions in copper of medallions, coins, &c., by the process of voltaism, you will remember that the idea occurred to me of giving them silver or golden surfaces, by a similar voltaic process; employing a solution of either of these metals in connexion with the prepared matrix, instead of a solution of copper. Turning the subject over in my mind, while walking home, a thought struck me, that a *complete* medallion of any kind of metal might easily be made by the voltaic process; or the medallion might be constructed of different metals, and in a variety of ways, which it would be found difficult to imitate by any other process. The following are some of the methods:—Let a matrix of each side of medallion intended to be copied, be made in the usual way, by means of the alloy usually called "Newton's fusible metal;" and let the metal be about an eighth of an inch in thickness. To the back of this metal is to be soldered one end of a copper wire, and to the other end a piece of zinc, which is afterwards to be amalgamated. The metal in which the matrix is formed, is now to be covered with a thin stratum of either varnish or wax, leaving bare the matrix only. The wire is also to be covered in a similar manner, and is to be bent so as to adapt the voltaic metals to their respective positions in the vessels holding the liquids employed. In a few hours the matrix will have received a coating of precipitated metal from the solution, which may be either gold or silver;

the thickness of the coating will depend upon the time. When this coating is supposed to be of sufficient thickness, remove the solution of the silver or the gold, as the case may be, and replace it by a solution of the sulphate of copper; and, in the course of a few days, you will have a considerable thickness of copper precipitated on the silver coating on the matrix. These two metals will adhere firmly together, so as to be one piece. When this joined semi-medallion is removed from the matrix, it will have a copper body with a silver or gold face. Its twin sister may be formed by proceeding in the same way, with the matrix formed from the opposite face of the original medallion; and, when the process is completed, the flat copper sides may be soldered neatly together, so as to form a complete medallion, similar to the original one. By a similar process a complete medallion may be formed, having a gold surface on one side, and a silver one on the other. Another beautiful variation may be made by the following process:—Imagine that we wanted a medallion, whose prominent parts should be of gold and the rest silver. The head of Newton, for instance, with its motto to be gold: varnish with wax every other part of the matrix, and put it in galvanic action in a solution of gold. In a few hours a golden head and motto will be formed. Now remove the gold solution, and clean the matrix of its coating of wax. Now put the matrix in voltaic action in a solution of silver, and the face of the new medallion will be filled up with silver. If the body of the medallion is to be silver, the action may be continued for a few days; but if the body is to be of copper, proceed as before directed, with a solution of copper. Similar processes give infinite scope to the ingenious, in varying and ornamenting this scale of voltaic production. Newton's fusible alloy, mentioned above, is formed by mixing five parts of bismuth, three of lead, and two of tin together, with heat; moulds with which may be made as follows:—When in a state just melted, pour a sufficient quantity on a piece of paper; take the medal, and, when the fluid alloy is ready to set, throw the medal upon it with an even, but a considerable force: by this means you will obtain a sharp impression of the coin or medal.

FELIX WEISS.

(*To be continued.*)

REVIEW.

Multum in Parvo; a New Work on Astronomy, the Magnet, Tides, &c. By THOMAS HEDGCOCK, Master, R. N. London: S. Kemshead, Kennington Lane, Lambeth.

THE task which the author of this volume has undertaken, is one of inextricable and hopeless difficulty; it is no less than the refutation of the Newtonian system, and substitution of a system, the merit of which our readers will have an opportunity of appreciating. The Newtonian, or, more properly, the *true* system of astronomy, does not depend upon the authority of philosophers, but is the result of the accumulated observations and discoveries of many centuries. The doctrine propounded by Kepler, was demonstrated by Newton, who discovered (not invented) the laws of gravitation; subsequent writers, having so much of nature unveiled to them, have, by the application of general principles, explained the minutest and most complicated variations in the motions of the heavenly bodies. A belief in the truth of this system does not depend upon opinion, but on the knowledge or ignorance of the mass of evidence, facts, and reasoning, which have revealed the laws by which the material universe is governed. We need not tell our philosophical readers, that Mr. Hedgcock has totally failed in his attempt to overthrow an edifice built upon so firm and goodly a foundation; but, for the satisfaction of the inquiring reader, and in justice to the author, we extract and answer some of the arguments he has employed to establish the truth of his assertions. "The sun," says our author, "is not 95,000,000 miles distant from the earth, as computed by the methods hitherto employed, but only 19,800 miles, and its circumference 672." The arguments which are to establish this theory, are declared by the author to be "very simple, easy, and accurate:"—

"Thus, on the 21st March and 21st September, two persons being on the same meridian in opposite latitudes; say, London's meridian and latitude, 51° 30. In observing the meridian altitude of the sun, the person in north latitude would observe the sun south; the person in south latitude would observe the sun north; their distance 103°, or 6180 miles the base. The sun the apex, forming an equilateral triangle."

Now if the side of an equilateral triangle be 6180, a perpendicular bisecting one of its sides from the opposite angle, will be $=\sqrt{6180^2-\left(\frac{6180}{2}\right)^2}$, which is evi-

dently less than 6180, and *à priori* less than 19,800; and that, without considering the convexity of the earth's surface, which would bring the equator still nearer to the sun. Again, he says,

"If two persons were at the poles, on the above days, they would observe the sun at the equatorial line of the earth in the horizon, and pass precisely around them in twenty-four hours; the person at the North Pole observing the sun south, and the person at the South Pole observing the sun north; and here, let it be observed, that either of those persons would appear to be on the uppermost part of the earth, and the sun literally below them."

The sun would appear *above* the horizon to each spectator, owing to the refraction of the atmosphere; and, by applying an exact correction, it will be found that the angle formed by the sun with the horizon at the pole, would give the real distance of the sun—viz. about 95,000,000 miles. We do not undertake to give an analysis of the work, but a persevering reader may possibly meet with original ideas, which ought not to be rejected because they are accompanied with a mass of error.

SELF-ACTING EXTINGUISHER.]

FIG. 1.

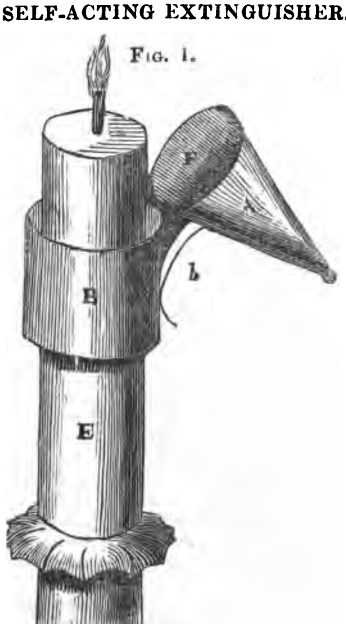
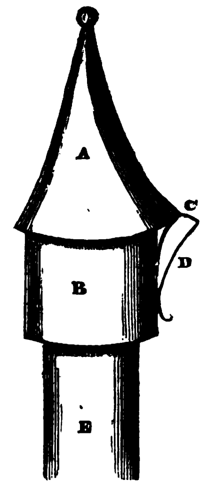


FIG 1 represents the self-acting extinguisher as it is placed on the candle. It is attached by a joint to the cylinder, B, made of thin elastic metal, so as to accommodate itself to candles of different thickness; D, a spring acting against B; F, a projecting piece attached to the extin-

FIG. 2.



guisher, A, and by which it is discharged; C, the joint; D, the spring. This apparatus may be made for a few pence, thereby enabling the most humble individual to possess it. J. PATERSON.

[This extinguisher does not appear to be entirely free from danger; when the wick is long, as is usually the case when a self-acting apparatus is required, the upper part might be thrown outside the extinguisher, and cause the very accident it is intended to prevent. There is an extinguisher used in Germany, which we think preferable to the above. It is placed on the candle in the same manner as shown at B; the upper part is divided like a bishop's mitre, and, when the candle burns down to it, it closes and immediately extinguishes the flame, by pressing the wick between two flat surfaces, similar to a common pair of fire-tongs.—ED.]

THE CHEMIST.

ON ALKALIES.

(Concluded from page 168.)

THEBAIA (Vegeto) was discovered by Couerbe. It exists in opium in small quantities only. It is said to be highly alkaline, and to form peculiar salts by solution in dilute acids. It requires farther examination.

Veratria (Vegeto), together with many others, we are again indebted for the discovery of this alkali to the indefatigable labours of MM. Pelletier and Caventon. It exists in the white hellebore, the veratrum sabadilla, and many other plants of this family. It is best procured from the seeds of the latter plant; for which purpose they are to be treated several times with boiling alcohol. These tinctures, filtered while still hot, deposit, on cooling, flakes of a white waxy matter; the substance remaining in solution, reduced to the consistence of an extract, is again taken up by cold water and filtered; the solution is then slowly evaporated, when an orange-coloured precipitate forms, exhibiting the characters of the colouring matter found in almost all ligneous vegetables. A solution of acetate of lead is poured into the liquor, which is still coloured, and immediately a very abundant precipitate forms, which is to be separated by filtration. The liquor, now nearly colourless, still contains, among other substances, the acetate of lead, which had been added in excess. The lead is thrown down by hydrosulphuric acid (i. e. sulphuretted hydrogen); the liquor being filtered, is concentrated by evaporation, treated with magnesia, and again filtered. The magnesian precipitate is treated with boiling alcohol, and these tinctures afford, by evaporation, the alkali in question. It is at first yellowish; but by repeated solution in alcohol, and precipitation by the addition of water, it is obtained colourless. It is sparingly soluble in cold water; but, if boiling, it takes up 1000th part of its weight, and becomes acrid. It is readily soluble in ether and alcohol. It saturates all acids, and forms with them uncrystallizable salts; if we except the super-sulphate, which alone presents a crystalline aspect. Veratria has no odour, but excites the most violent and dangerous sneezing. I once had occasion to rub two grains of it in a mortar with a drachm of lard, but, notwithstanding all my precaution, sufficient was dissipated into the air to cause me to sneeze for full half-anhour. It fuses at 122° Fah., and in this state has the appearance of wax. On cooling, it concretes into an amber-coloured mass: subject to destructive distillation, it yields water, a great deal of oil, &c., and leaves a large quantity of charcoal. Iodine and chlorine produce, with veratria, an iodate, hydriodate, chloride, and hydrochlorate. MM. Dumas and Pelletier have made three analyses of veratria derived from the "sabadilla," which does not materially differ:—

Carbon	65.65
Nitrogen	5.04
Hydrogen	8.54
Oxygen	19.60
Loss	1.17
	100.00

SEPTIMUS PIESSE.

41, Oxford Street.

DRAWING ON VELLUM.

VELLUM, being a fine clear substance, and of great durability, is often used for deeds and plans of consequence. Now, though plans can be, and are finished off with great nicety on vellum, it is much more difficult to make a plan look really well on this substance, than on the common drawing paper. A few practical remarks on the subject may, therefore, be useful.

To Strain Vellum, it is merely necessary to damp the back of the skin with a wet sponge; leave it for a few minutes to soak into the skin, then extend it to the required size, and secure it on each side with small nails.

In Penciling the Plan, the lines must be lightly drawn with a soft pencil, and should not be drawn beyond the angles, or they will remain after the plan is finished, and destroy the neatness of appearance which is so requisite to a well-finished plan. These lines should be inked in faintly, else the colour, when put on, will mingle with the ink, and look rather dingy.

When the ink lines are quite dry---and, in fact, it is better to leave them for a day or so before colouring—the parts to be tinted must be washed over with plain water, as carefully as if it were colour; taking pains not to exceed or fall short of the lines that bound it, or the colour will, in such places, collect in grains, and offer a rough ragged edge.

In about half a minute, when the skin appears dry, though still damp, lay the colour on with care, and rapidly; and it is preferable to have several coats of tint mixed but lightly, than one coat alone of the required intensity.

When writing on such a plan, some common ink should be mixed with the Indian, to render the letters permanent;* for when foreign ink alone is used, a person skilled in such matters can with ease alter a plan, and puzzle the lawyer.

PROPORTIO.

* The same plan is adopted with advantage in the lines of the plan, as well as the writing.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, October 7, G. H. Pell, Esq., on Fluctuations in the Quantity, and, consequently, in the Value of the Currency—On the Causes and Effects of such Fluctuations, and on the Means of Prevention. Friday, Oct 9, H. H. B. Paull, Esq., on the Works of Byron, with Illustrations. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street. — Thursday, Oct. 8, H. Hersee, Esq., on Elocution—Physical Department. At half-past Eight.

Franklin Mutual Instruction Society, Halfmoon Alley, Lower Whitecross Street.—Monday, October 5, Rev. W. Vidler, on Astronomy. At half-past eight o'clock.

QUERIES.

Can any of the readers of your valuable periodical inform me, where and at what prices I can purchase a small printing press complete, type and ink? J. KNOWLES.

How to dye wood a mahogany colour? W. T.

How is burnt steel made fit for use again? A. M. A.

TO CORRESPONDENTS.

S. S. *writes as follows:—"A recent Act, protecting inventers in the way of copyright, and by the registration of new designs and patterns, from the unprincipled appropriation by others of the fruits of their labours, talent, and ingenuity, can, I am assured, be made subservient to the protection of any invention; either to afford a shorter, but also cheaper term of monopoly, or to enable an inventer to experimentalize with safety previously to taking out a patent. Can my informant be correct when he maintains, that the above protection can be made to embrace novel mechanical contrivances, new machinery—nay, chemical discoveries? I feel great doubts as to the reliance which can be placed on its securing inventers in those branches from piracy. Rest assured that, although I express such doubts, I most sincerely hope that I may be wrong, since ingenuity wants such protection; because it is but too frequently preyed upon, on grounds of poverty, by men of purse; talent not always, perhaps rarely, being seconded by means not only to take out patents, costly and insufficiently protecting as they are, but even to follow up experiments whereby to convince others that the command of wealth is offered to them, for even a mess of porridge, generally, by one of the so-called and unjustly despised poor 'schemers,'* to whom this country, nevertheless, is mainly indebted for its manufacturing and commercial pre-eminence, and for its stupendous monuments of mechanical triumph. *The men of metal certainly furnish the ore; but who directs and works its conversion into a many hundred-fold improved value—not always obtaining thereupon even the necessaries of life, while they are dispensing opulence on numbers by their talent? Alas! poor Schemer, thou art not only 'more sinned against than sinning'—but rarely sinning, ever sinned against, and libelled too, even by those who profit by thy labours!" The Legislature has taken good care that the Designs Copyright Act (2 Vic. c. 17) shall not permit the poor man to escape the penalties with which merit is visited by the wicked patent laws. It is intended to afford great manufacturers a temporary monopoly of particular patterns, as follows:—*

"1. For the pattern or print to be either worked into or worked on, or printed on, or painted on, any article of manufacture being a tissue or textile fabric.

2. Or for the modelling, or the casting, or the embossment, or the chasing, or the engraving, or for any other kind of impression or ornament, on any article of manufacture.

3. Or for the shape or configuration of any article of manufacture."

No invention or process beyond this is admitted; and any design revealing an invention, would expose that invention to unrestrained piracy at the expiration of one year, or three years, according to the nature of the design. Articles in metal are protected by registration for a term of three years, on payment of three guineas; and other articles, for one year, on payment of one guinea, exclusive of the charges for agency, &c.

Mr. Hewet *will find a letter at our office concerning his gilding process.*

Scientia.—*We regret that his communication arrived too late for insertion in our last, and the present Number will not appear till after the meeting. We shall be glad to receive his promised communication.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by DOUDNEY & SCRYMGOUR (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

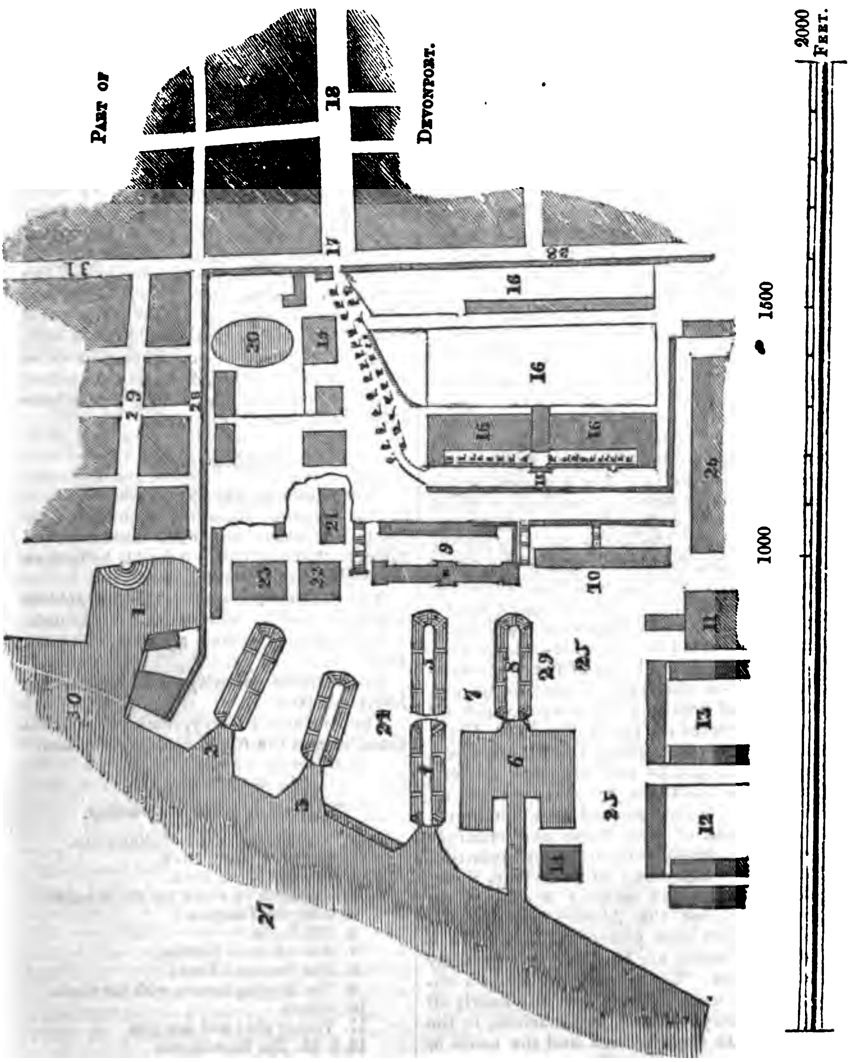
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 114, NEW SERIES. | SATURDAY, OCT. 10, 1840. PRICE ONE PENNY. | No. 235, OLD SERIES.

PLAN OF PLYMOUTH DOCK-YARD.



City Press, 1 Long Lane: Doudney and Scrymgour

THE FIRE AT DEVONPORT DOCK-YARD.

(See Engraving, front page.)

As the attention of the public is at present much directed to the above lamentable occurrence, we are enabled this week to present our readers with a ground plan of that part of the Dock-yard where the fire raged; for the accuracy of which we can vouch, as it was prepared by Mr. Joshua Claringbull, whose very excellent work upon the Plymouth Breakwater we reviewed a few weeks since. We may take this opportunity of stating, that the same talented individual has been for some months preparing a map of the towns of Plymouth, Devonport, and Stonehouse, with the parts adjacent, which will shortly be published under the distinguished patronage of the Board of Admiralty, Trinity Board, &c. &c.

Our readers having already had access to the various particulars respecting the above fire, through the medium of the daily press, we shall limit our statement as much as possible.

At twenty minutes past four on Sunday, Sept. 27, the police officer on duty in the northern division of the Dock-yard, observed a mass of smoke issuing from the bow of the *Talavera*, in the Stern Dock. He instantly ran to the station and gave the alarm. Lieut. Williams, R. N., the police superintendent, was on the spot with the engine in a few minutes; but it was instantly seen that no human effort could save the ship, for the whole bow was in flames. Near the *Talavera* lay the *Minden*, 74, in what is called the Head Dock, her bow lying within a few feet of the former's stern. The *Imogene* frigate lay in the South Dock, between which and the others stood the Adelaide Gallery, containing the figure heads of the old broken-up ships of the navy, preserved as mementos of past glories—a spot which always attracted the notice of visiters. Right and left of the gallery were large sheds, containing planks and prepared timber; and here were the workmen's tools, all ranged in boxes, marked and numbered. The whole of these docks and buildings were surrounded with immense quantities of timber, consisting of pine logs, deals, knees, &c.; and scarcely a vestige remains, except the *Minden* line-of-battle ship, which was preserved, though in a damaged state, her bow having repeatedly caught fire. There were twenty-two engines at work at one time; and nearly all the military, seamen, and marines, in the port, with their officers and the heads of the different departments, were present at an early hour.

All that human exertion could do, was done with courage, alacrity, and skill, highly praiseworthy. Admiral Sir Graham Moore and Admiral Warren were on the spot immediately after the alarm was given. Fortunately the flames were prevented from igniting the rigging-house, which stands close to the South Dock, and contains all manner of combustibles.

The fire was not entirely got under until late at night. The *Talavera* was an old ship; and the estimate of her worth, if sold by auction—the usual mode of disposing of ships when unserviceable—is not above 20,000*l.*; though to replace her with a new ship of the same class, would be from 70,000*l.* to 80,000*l.* The other vessels must be estimated in the same way; but the loss of stores is immense. The sheds, covered as they were with painted and tarred paper, cost from 10,000*l.* to 12,000*l.* each; the cost, when covered with copper, is from 30,000*l.* to 40,000*l.* each. The granite facings of the docks are split to pieces. The fire was providentially stopped at the very point where the destruction would have been greatest, as property amounting in value to upwards of 5,000,000*l.* was deposited in the very building adjoining that where its progress was terminated.

DAMAGE DONE.

The *Talavera*, 72, entirely burned.

The *Imogene*, 28, entirely burned.

The *Minden*, so much charred and burned, that she will, no doubt, be broken up or razed to a frigate.

The South Dock and the Inner Middle Dock destroyed; stone work all calcined.

Four sheds, valued at about 40,000*l.* each.

An immense quantity of deck-planking lately received.

The Adelaide Gallery, with all its contents, except the *Royal George*'s capstan.

Description of the Engraving.

No. 1. The North Corner Landing-place.
2. The New North Dock.
3. The Old North Dock.
4. The Dock in which lay the *Minden*.
5. Ditto the *Talavera*.
6. The Basin.
7. The Adelaide Gallery.
8. The *Imogene*'s Dock.
9. The Rigging-houses, with the clock.
10. Offices.
11. Timber shed and saw-pits.
12 & 13. The Store-houses.

14. The Master Attendant's Office.
15. The Admiral Superintendent's House.
16. The Officers' Houses, Gardens, and Stables at the back.
17. The Dock-yard Gates.
18. Fore Street.
19. The Dock-yard Chapel.
20. The Reservoir.
21. The Saw-mills.
22. The Engine and Machinery House.
23. The Smithery.
24. Space occupied by sheds and piles of timber.
25. Ditto ditto.
26. The Boat-houses, Sail-lofts, &c.
27. The Hamoaze.

HALL'S PATENT PROCESS FOR PRESERVING AND RENDERING WATERPROOF WOOLLEN AND OTHER FABRICS, AND LEATHER.

(Abstract of Specification.)

My invention relates to the application of certain chemical combinations, to which the materials to be water-proofed or preserved are to be subjected, as hereafter described.

First Preparation.

Take of alum, powdered, two ounces; pure water, or distilled, one pint, of sixteen ounces to the pint, and dissolve the alum in the water. Then take of dry whitelead of commerce, one ounce, rubbed well down in half of a pint of pure water; when well united, put the two solutions together, and let the precipitate subside, which done, decant the supernatant liquid, and pass the cloth, &c., through it immediately; or take of dry whitelead of commerce and alum, powdered, of each one ounce, and of acetic acid two fluid drachms; pure, distilled, or rain water, one pint imperial; rub the whitelead down in a little of the water, and dissolve the alum in the remaining water; mix the acetic acid with the dissolved alum, and then mix the solution of whitelead and water with the solution of alum and acetic acid; let the precipitate subside, and then pass or immerse the cloth, &c., through the supernatant liquor directly. I recommend it to be done directly, because I consider it better to do so, though it is not essentially necessary. Having submitted the woollen or other fabrics or leather, to either of the above preparations or chemical combinations, they may be submitted to the following preparation:—Take of quicklime half-a-pound, mix it with one-and-a-half gallons of water, cold; pure, distilled, or rain, and pass the fabric or leather through this preparation; when this has been done, dry, or partially dry, the fabric or leather, and pass it through a solution formed thus:—Take of clean picked Irish moss (moss carragreen), two ounces to be boiled in three gallons of pure water, distilled, or rain, to be boiled down to two gallons; then strain through a fine flannel or other bag, so that no specks are seen in the solution; when strained, add to it two gallons more of pure water, and then, when well mixed, pass the fabric or cloth through the liquor, taking care to press the fabric, so that too much of the fluid mucilaginous matter does not remain, but only just sufficient to fix the water-proofing material in the fabric, &c. The preservative solution is made thus:—Take of camphor one ounce, two drachms; crude arsenic reduced to powder, eight ounces; white soap, eight ounces; salt of tartar of the shops, three ounces; prepared chalk, reduced to a fine powder, one ounce. Cut the soap into fine slices, and put it into a pot over a slow fire, with a little water, stirring it often with a wooden spoon or spatula; when melted, put in the salt of tartar and prepared chalk; take it off the fire and add the arsenic; saturate the whole gently; lastly, put in the camphor, which must be in fine powder. To make the preservative liquid, take the above preparation, and add to it one gallon of pure, rain, or distilled water. And one of my processes is, sometimes to add one ounce of this preservative preparation, made as above, with one gallon of water, in the proportion of an ounce to a pint of the first and second preparations, whichever is employed, and so waterproof and preserve at the same time. I would remark, that when the first preparation is used in its simple state, the process of the lime water is not necessary. When I am operating on thin fabrics, I prefer to partially dry them before passing them through the solution of lime. I would remark, that although I have been particular in describing exact quantities, which I have generally employed, I do not confine myself thereto; and, when preserving fabrics or leather, the camphor may be omitted in the mixture, if the smell be objected to; and, farther, if extra-strong thick fabrics be operated on, I make the mixtures stronger than those above given. After the fabrics have been treated as above explained, I dress and press them for the market in the ordinary ways now practised in respect to the particular fabric.

DESCRIPTION OF ELECTROTYPE.

(Concluded from p. 189.)

SINCE the publication of Mr. Spencer's pamphlet in September, 1839, the following letter has appeared in the *Athenæum*, dated June 27th, 1840:—

" Sir,—I take this opportunity of laying before yourself and readers a brief detail of a still farther improvement of my voltaic process, of multiplying works of art in metal. In my pamphlet, I stated that I considered the process comparatively incomplete, unless we were able to apply it to the multiplication of models in clay or wood, castings in plaster, wood engravings, &c.; as the fact that galvanic deposition always requires a metallic surface to act on, seemed to set bounds to these branches of its application. I then resorted to various expedients to surmount the difficulty; among others, that of gilding and bronzing the surfaces of such materials to a limited extent; this was successful, but still troublesome and expensive, and, more than all, the sharpness and beauty of the original were necessarily injured. I have since attempted to metallize surfaces by the use of plumbago (suggested to me many months ago by Mr. Parry, of Manchester). This last possesses some of the faults common to the others in a greater degree, and, in some instances, the deposition goes on partially. I am happy, however, to inform you, I have now adopted a method which answers completely, obviating all these objections, and leaving the surface of the material to be acted on as sharp as it was previous to the operation. Should I be desirous of obtaining a copper mould or cast from a piece of wood, plaster, or clay, or, indeed, any non-metallic material, I proceed as follows: — Suppose it is an engraved wooden block, and I am desirous of metallizing it, in order that I may be able to deposit copper on its surface (this example will hold good for any other material), the first operation is, to take strong alcohol in a corked glass vessel, and add to it a piece of phosphorus (a common vial corked will answer the purpose); the vessel must now be placed in hot water for a few minutes, and occasionally shaken. By this means the alcohol will take up about 300th of its bulk of phosphorus. The next operation is to procure a weak solution of nitrate of silver, place it in a flat dish or saucer; the engraved face of the block must now be dipped in this solution, and let remain for a few seconds, to allow capillary attraction to draw it into the wood. This operation being performed, a small portion of the alcoholic solution of phosphorus must now be poured in a capsule or watch-glass, and this placed on a sand-bath, that it may be suffered to evaporate. The block must now be held with its surface over the vapour, and an immediate change takes place; the nitrate of silver becomes deoxidized and gives place to a metallic phosphoret of silver, which allows the voltaic deposit to go on with as much rapidity and certainty as the purest silver or copper. The whole process may be performed in a few minutes, and with absolute certainty of success. The interior or exterior surface of a plaster or clay mould of a statue, no matter what size, may be thus metallized with equal facility. For the purpose of vaporizing, and should the material to be acted on not be very large, I prefer fastening it to the top of a bell-glass receiver, with a bit of pitch or cement, and thus placing it over the capsule on the sand-bath; the phosphoric vapour is by this means equally diffused and not dissipated. An ethereal solution of phosphorus also answers; and a solution of either of the chlorides of gold or platinum may be used. I am inclined to think this process, independent of its uses in galvanic precipitation, may be applicable to other branches of art. I would recommend those curious of testing its effects, to try a sharp and small plaster-of-Paris medallion: dip its surface in a weak solution of nitrate of silver, and take it out immediately; fasten to the bottom of a glass tumbler, and, at the same time, have a little hot sand ready in a dish; lay the watch-glass, containing a few drops of the phosphoric solution, on it; now place the mouth of the tumbler over all, and the medallion will be observed almost instantly to change colour. The operation is now completed. A piece of pottery ware in the state of biscuit, may be acted on in a similar manner. THOMAS SPENCER."

Up to the present date, nothing more has been communicated by Mr. Spencer; but as the process is at present in its infancy, we may expect more new applications of it every day. Indeed we find that M. de la Rive has succeeded in gilding metals, which method he describes as follows:—" Pour a solution of chloride of gold (obtained by dissolving gold in a mixture of nitric and muriatic acid), as neutral as possible, and very dilute, into a cylindrical bag made of bladder; then plunge the bag into a glass vessel containing very slightly acidulated water. The process may be varied, if the operator pleases, by placing the acidulated water and zinc in the bag, and the solution of

gold with the metal to be gilded on the glass vessel. In the course of about a minute the metal may be withdrawn, and wiped with a piece of linen; when rubbed briskly with the cloth, it will be found to be slightly gilded. After two or three similar immersions, the gilding will be sufficiently thick to enable the operator to terminate the process." Silvering or platinizing metallic plates may be done by a similar method; but the praise is due to Mr. Spencer, as it is the necessary consequence of his discovery. I have now proceeded far enough to enable those who wish, to continue this process; and I leave it, with the hope of soon hearing of some new application made by some of your numerous correspondents. F. Weiss.

ON THE TEMPERATURE OF MOST EFFECTIVE CONDENSATION IN STEAM-VESSELS.

At the tenth meeting of the *British Association for the Advancement of Science*, the following paper on "The Temperature of most effective Condensation in Steam," was read by J. Scott Russell:—

Much has been said regarding the perfection of the vacuum formed in the condenser of a steam-engine, especially a marine engine. It does not appear to be known, that a vacuum may be *too good*. We hear it boasted every day by rival engineers, that their engines have the best vacuum. Some boast their vacuum at 27 inches, others at 28, others at 29, some at 30, and, at last, an engineer appears who boasts a vacuum at 30½ inches! It is to be regretted that time and talent should be thus wasted. It is a fact of great importance, and it is the result of theory, established on incontrovertible truth, and confirmed by experiment and by practice, that a vacuum may be too good, and become a loss instead of a gain. The truth is simply this, and should be known to every engineer:—*If the barometer stand at 29½ inches, the standard of this country, the vacuum in the condenser is* too good *if it raise in the barometer more than 28 inches of mercury.* This important truth is incontrovertible—it is practically exhibited every day. The following is a simple proof of this doctrine, divested as far as possible of a technical form, and put in the shape of an inquiry into the best state of a condenser:—

Let l = the caloric of water of 1°;
c = the constituent caloric of water in the state of steam;
e = the total force of steam in the boiler, in inches of mercury; and
x = the elastic force of steam at the temperature of best condensation, which we seek to discover.

Then from the law which connects the elastic force of steam with temperature, it follows, that in case of maximum effect, or the temperature of best condensation,

$$\frac{l}{c} = \frac{x}{e};\ \text{that is, } x = \frac{el}{c}$$

Now c is 1000; and if the steam in the boiler be at 5 lb. above the atmosphere; or if $e = 40$ inches of mercury, and $l = 1$,

$$x = \frac{40}{1000} = 0.04.$$

Again, if the steam be at 7½ lb. = 45 inches,

$$x = \frac{45}{1000} = 0.045.$$

Again, if the steam be at 10 lb. = 50 inches,

$$x = \frac{50}{1000} = 0.05.$$

Hence we find, that the best elasticity or temperature in the condenser depends on the elastic force of the steam in the boiler.

With steam of 5 lb. in the boiler, the elasticity of maximum effect in the condenser is 93° Fahr., and the best vacuum on the barometer is 28.

With steam of 7½ lb. in the boiler, the elasticity of maximum effect in the condenser is 95°; and the best vacuum on the barometer is 27.8.

With steam of 10 lb. in the boiler, the elasticity of maximum effect in the condenser is 97°, and the best vacuum on the barometer is 27.6.

In like manner it would be found, that with steam of 50 lb. in the boiler, worked expansively, as in Cornwall, the best vacuum in the condenser would be about 26 on the barometer.

It is hoped, therefore, that engineers will not in future distress themselves at finding the vacuum of their condenser much less perfect than the vacuum of others who have obtained 30 and 30½ inches at so great loss of fuel and power. To obtain a vacuum of 29½, with the weather-glass at 29.75, and steam at 7½ lb., would be to sacrifice four horses' power out of every hundred. In a day when the barometer is as low as 28½ inches, the vacuum in the condenser would indicate 26.8. In speaking of the

vacuum in the condenser, it would save much ambiguity to indicate the elasticity merely of the steam in the condenser; thus, if the barometer stand without at 29½, and the barometer of the condenser at 28, it might be stated that the steam in the condenser stands at 1½, being the point of maximum effort. The indication would convey at all times more precise information..

STOCKTON AND HARTLEPOOL RAILWAY.

THIS railway, which is now rapidly approaching to its completion, has advanced in so quiet and unobtrusive a manner, and with such rapidity, that comparatively few persons are aware even of its existence; and yet, from its importance in a commercial point of view, and the peculiar and interesting features displayed in the engineering works on some portions of the line, it certainly deserves to be more generally known, and we therefore hope the following short description of it may not be altogether uninteresting to our readers.

The southern extremity of this railway commences by branching from the Clarence Railway, near Billingham, at about two miles from the Stockton branch, with a short and gentle curve of half-a-mile in length over a low embankment, and then continues in a perfectly straight line, passing through the retired village of Cowpon, over ground peculiarly favourable for economical construction, to the Greatham Meadows, where we encounter the principal work on the line, the Greatham viaduct; and, from its great magnitude, we will pause in our farther progress, to give a more particular description of it.

Greatham viaduct, which appears now nearly completed, is about 700 yards in length, consisting of ninety-two semi-circular arches, the whole being built of bricks, with the exception of the cornice and coping, which are of Ashlar stone; the continuity of this long range of semi-circular arches is broken or relieved in one place by an arch of large dimensions, which crosses the railway at a considerable angle of askew, to admit the Claxton Brook through it, without any alteration to the direction of its course. The height of the viaduct, when compared with its length, may appear almost insignificant, being only about thirty feet; but from the immense pile engines, of which some few are yet remaining erect, which have been used, it is evident the principal difficulty has been underneath the surface of the ground and not above it; the piers are founded upon large bulks of timber driven by these ponderous engines, sixty feet deep, through a soft stratum of silt into the solid clay; and some idea may be formed of the immense labour attending it, when we state, that about 30,000 cubic feet of timber are buried in these foundations. An interesting discovery was made when the borings were taken of this ground, in the complete development of an old channel or water-course, at a depth of fifty feet below the present brook, and of much larger size, exhibiting gravel and sand in its lowest point, with slopes rising therefrom, corresponding to a water-worn channel; the stratum between this old channel and the present surface of the ground, is, as we have before observed, entirely composed of soft silt, and has evidently been warped up by the sea at some former period, although, at present, the rich and verdant meadows upon it exhibit no traces of its former state.

Upwards of 500 men have been constantly employed upon the work since its commencement, and the whole has been piled and built to its present state within about three months, being, perhaps, the shortest time in which so large and difficult a work was ever constructed.

On leaving the viaduct, we pass, for about a mile, over a lofty embankment, whence we have a most delightful view of the Tees' mouth and the Yorkshire hills; and, after crossing the Greatham Brook, we enter a long and deep excavation, extending for nearly two miles through a stiff marly clay, emerging to the natural surface of the ground exactly opposite Seaton; then curving, by an extremely gentle sweep, the line passes over an embankment of considerable length, extending from the Seaton road to a little beyond Cliffe House, where we enter a shallow cutting of half-a-mile in length, terminating near New Stranton. At this point we have an important and interesting work in the clay embankment against the sea, which we shall stay to notice.

This embankment, erected for the protection of the railway, extends three-quarters of a mile in length, and is formed entirely of clay puddling, worked to a peculiar and scientific form; so that when the waves dash upon it, they harmlessly run up its smooth curvilinear surface; and, to all appearance, it becomes more firm and substantial by exposure and age. It is believed to be the first embankment of the kind attempted in a similar situation.

Stations are building at New Stranton, Seaton (visiters to which favourite and fashionable watering-place will find great advantages from the establishment of this line), Greatham, Newport, and Billingham; and it is intended to have these stations, and the passenger accommodation generally, on the same scale of elegance and convenience observed on railways in the south of England.

The permanent rails are laid about half the length of the line; and the directors intend to open throughout about the 1st day of October next.

We cannot conclude our observations, without noticing the persevering and indefatigable exertions of Messrs. Leather and Son, the engineers in chief; of John Fowler, Esq., the resident engineer; and of Mr. Thomas Hutchinson, the able and spirited contractor, by whose united exertions so much has been accomplished.—*Yorkshireman.*

PLANTS AND ANIMALS FOUND IN SULPHUREOUS SPRINGS.

At a meeting of the *British Association*, Dr. Lankester gave an account of several plants and animals which have been found in the sulphureous springs of Askern and Harrowgate, in Yorkshire. The existence of organic matter, or substances closely resembling them in their chemical nature, has been long known to writers on mineral waters and under the names *glairine*, *zoogene*, &c. Of these, *glairine*, a substance found in thermal and cold sulphur springs, has excited most attention. Many Continental writers trace the origin of this substance to chemical changes; but Dr. Daubeny is of opinion that its origin is organic. The existence of organic matter with a definite form, was first pointed out by Willan, and afterwards described by Dillwyn, as a plant under the name of *conferva nivea*. This plant was found by Dr. Lankester in the sulphureous waters of Askern, in Yorkshire. In its early stages of growth, it corresponds with the organic fibres described by Dr. Daubeny, and, in a more mature state, with the plant as described by Dillwyn. It is of exceedingly rapid growth, and is found in waters impregnated with sulphuretted hydrogen, after being exposed to the atmosphere for a few hours. It rapidly decomposes, giving rise to secondary combinations, which closely resemble the characters of *glairine*, as given by Professor Anglada. In the waters of Harrowgate, another species of conferva abounds, which in its structure resembles a species of *oscillatoria;* it collects in large quantities around the sides of the wells, and, with deposits of inorganic and animal matters, forms layers of a dark-green, white, and rose colour. In decomposing, these plants give out a more powerful odour than the water itself; a circumstance which has given rise to the opinion, that a sulphuret of azote exists in these waters. These plants are peculiar to sulphureous waters, and probably have their existence determined by the sulphuretted hydrogen they contain. Throughout a large district in the neighbourhood of Askern, springs of water arise impregnated with sulphuretted hydrogen, and the soil around becomes saturated with it. In places where water runs over or collects on this soil, deposits are frequently seen varying from a light-pink to a beautiful rose and carmine colour. These deposits rapidly appear and disappear, and have been found by the author to depend on the presence of two species of animalcules. One is oblong, with from two to ten stomachs, about the one-ten thousandth of an inch long, and with rapid movements; the other is much longer, having about the same number of stomachs, and in its motions and shape very much resembles a *vibrio*. The first resembles the *astasia hæmatodes* of Ehrenberg, but it does not possess a tail, which is a characteristic of the genus *astasia*. This animalcule was found by Ehrenberg, forming a blood-coloured sediment in a lake on the Steppe of Platow, in Siberia. These animalcules live in water artificially impregnated with sulphuretted hydrogen: they have never been seen in any place where sulphuretted hydrogen did not exist; and, in many instances, the author has been able to detect this gas by their presence, in places where he did not suspect its existence.

MISCELLANEA.

To Extinguish Fire in Steam-Vessels.—The following is an account of a successful experiment made on board the *Leven* steam-boat by Mr. Wallace:—On the cabin floor, a space of ten feet by fourteen was covered with wet sand, on which were laid iron plates, and on these a fire was kindled, with about 4½ cwt. of very combustible materials, such as tar barrels, &c. A hose, thirty-four feet long, two-and-a-half inches in diameter, extended from the boiler of the engine to the cabin, and, when the fire had been sufficiently kindled, so that the panes of glass in the windows of the cabin began to crack by the heat, the steam was let in, and the doors of the cabin shut. The fire was extinguished in about four

minutes. Several trials were made, and all with like success. On another trial, a metal pipe of a greater diameter than the hose, was connected with the steam-boiler, and extended into the cabin. A small square hatch was cut in the deck immediately above the cabin, and through this opening were lowered down into the cabin two moveable grates, each containing a blazing fire, well kindled of about 1 cwt. of coals. The hatch on the deck and cabin doors were then shut, and the steam let in, and in fifteen minutes the small hatch was opened, and one of the grates hoisted up, when the whole mass of coal and cinders, which had before formed a powerful fire, were found to be completely extinguished. This experiment was repeated twice with equal success.

Opposition to Railroads.—The *John Bull* newspaper, in its last attack upon railway travelling, after showing how that mode of conveyance propagates vice and intemperance, and leads to various fatal results, which were never before dreamed of, and, probably, never will be dreamed of again, concludes with the following hypochondriacal vision:—"Then, again, the barbarous cruelty to which the horses employed to drag the heavy waggons, loaded with earth, to the end of the line in progress, is heart-rending to look at. These horses are trained to drag these waggons to a point on the line, and then to detach themselves from them, leaving the waggons to run to the end, where they, by their own force, shoot out the load of earth; and, in order to give these waggons the proper impetus to deposit their contents in that manner, it is necessary that the single horse drawing them should gallop at full speed for a certain distance before it detaches itself—to effect which dreadful exertion, the 'lash of the driver,' as Lord Brougham has it, is mercilessly applied to the panting animal, which not unfrequently is hurled down the precipice with its galling load, fortunately, perhaps, terminating its miserable existence." This, it is true, is only an opposition *pour rire*; but it shows that the cause of the stick-in-the-mud party is as hopeless as it is absurdly and doggedly persisted in. Those who still oppose the railway system, after its triumphant and transcendent success, resemble "a donkey that won't go," rather than a rational being contending for truth by fair argument.

Insects in Chalk.—Professor Ehrenberg has made some remarkable discoveries in the course of his various experiments on chalk. He found that a cubic inch possessed upwards of a million of microscopical animalcula: consequently, a pound weight of chalk contains above 10,000,000 of these animalcula! From his researches it appears probable, that all the strata of chalk in Europe are the product of microscopical animalcules, most of them invisible to the naked eye.

Croydon Railway.—On Monday the 5th inst. being Croydon fair-day, upwards of 400*l.* were taken at the Croydon Railway station, notwithstanding the unfavourable state of the weather.

To Stain Wood of a Mahogany Colour.—Take two ounces of gum tragacanth, break it in pieces, and put it into a quart of rectified spirits of wine; let the bottle stand in a warm place; shake it frequently, and, when dissolved, it is fit for use. T. J. B.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, October 14, R. H. Semple, Esq., on the Metals. Friday, October 16, Rev. William Vidler, on the Natural History of the Carnivorous Mammalia. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, Oct. 20, Election of Officers. At half-past eight.

Franklin Mutual Instruction Society, Halfmoon Alley, Lower Whitecross Street.—Monday, October 12, J. Smith, Esq., on Provident Institutions. At half-past eight o'clock.

Chemical and Philosophical Society, No. 241, High Street, Shoreditch.—Wednesday, October 14, Mr. H. Wiglesworth, on Electricity. At half-past eight precisely.

ANSWER TO QUERY.

Polishing Horn.—Having read in your invaluable Magazine some remarks upon polishing buffalo horns, signed "J. Child," I beg to state, for the information of your correspondents, that janister stone burnt and powdered, and used with rotten-stone instead of pumice-stone, will be found to answer much better. In case the "hand of a female" cannot be procured, a piece of soft wash-leather will be found an excellent substitute. H. L. M.

TO CORRESPONDENTS.

W. Sproule's *steam-boiler will appear as soon as the engravings are ready.*

Numerous correspondents will be noticed in our next.

London: Printed at "The City Press," 1, Long Lane, Aldersgate, by Doudney & Scrymgour (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. Berger, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 115, NEW SERIES. | SATURDAY, OCT. 17, 1840. PRICE ONE PENNY. | No. 236, OLD SERIES.

WILLIS'S PATENT WEIGHING MACHINE.

Fig. 3.

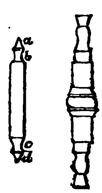
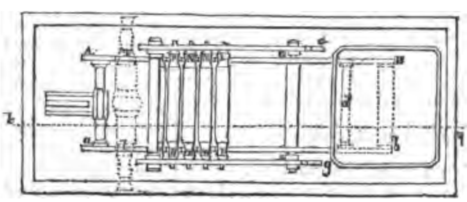


Fig. 1.



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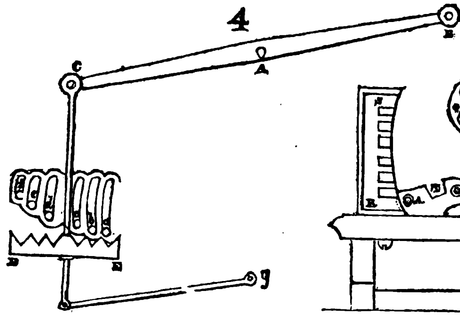

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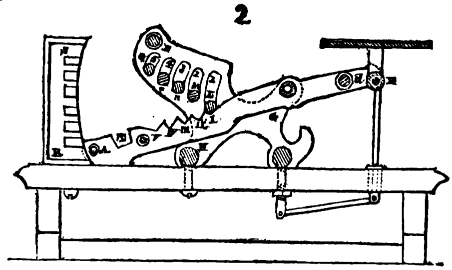
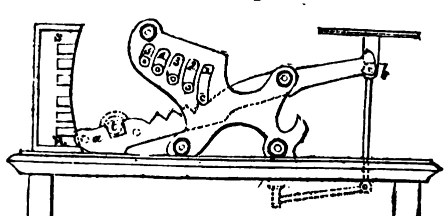


Fig. 2½.



City Press, 1, Long Lane: Doudney and Scrymgour

WILLIS'S PATENT WEIGHING MACHINE.

THE inventer of this machine is the Jacksonian Professor of the University of Cambridge; it possesses an advantage over other self-registering weighing machines, in being exempt from the inconvenience of oscillation, which, in most apparatus of this kind, causes much uncertainty and delay. There is, however, one objection to this construction, which may, perhaps, be obviated by the ingenuity of some of our readers: no provision is made for determining the exact weight of bodies which are heavier than one of the series of weights, and lighter than the next in succession; but, with the exception of this defect, we consider it a practically useful machine. The following description is in the inventer's own words, abstracted from his specification:—

Description of Engravings.

" Fig. 1 is a plan of the machine.

Fig. 2, a vertical section made along the line, *k g*, of the plan.

Fig. 2½ is an elevation of the machine. The same letters of reference are applied to the same things in all the figs. A B, *a b*, is a rectangular frame, which constitutes the beam of the balance. This is formed of two similar pieces, A B, *a b*, the form of one of which is seen in fig. 2; these pieces are kept at the proper distance by pillars or other frame-work, as at *c d*; and there is a knife edge at E *e*, fixed to them. The frame of the machine is formed of two parallel plates of a similar form, F G, *f g*, the shape of one of which is seen in fig. 2. These plates are fixed at the proper distance asunder, by means of pillars or other well-known contrivances, as at *h* H, and the whole may be attached to a board or pedestal. The knife edges, E *e*, rest in holes or cups attached to the plates of the frame, and formed in any manner usual to scale-makers, so that the beam of the balance may turn freely thereon. At B *b*, the beam is provided with other knife edges, or suspending pieces of any usual form for the reception of the scale, which is to receive the article to be weighed, and which may be made in any form that is thought best adapted to receive it. The scale-pan, which I prefer, and which is represented in the figures, is that which is usually denominated a Medhurst pan. The weights employed are shown at L *l*, M *m*, N *n*, P *p*, Q *q*. I have, for the sake of simplicity, merely shown five, but a greater or a less number may be used. These weights I prefer to be of a long and narrow shape; and I usually make them of such a form, as may be turned in a lathe for the convenience of manufacture. At each end of the weight (one of which is represented separately at fig. 3), two necks are provided, as at *a b* and *c d*. The plates of the frame have a series of curved openings, 1, 2, 3, 4, 5, fig. 2, the breadths of which are somewhat greater than the diameters of the extremities, *a d*, fig. 3, of the weights; and the weights, when not in use, lie in and rest upon the bottoms of these openings, in the manner shown in the figures; but are prevented from escaping from the frame by the shoulders between the grooves, and by the looped form of the openings in which they lie. On the upper edge of each side of the balance-beam, are formed angular notches, as at I., II., III., IV., V., each pair of which corresponds to one of the weights, and is so placed that, when the beam rises, each pair of opposite notches will be brought in succession under its appropriate weight, and will lift it up by means of the necks already described, *b c*, fig. 3, which are provided for the purpose. The action of the machine will be best shown by an example:—Let the machine be formed to measure the weight of any article in ounces. In this case, the gravity of every separate weight must be so proportioned to the distance of the beam notches from the fulcrum or central knife edges, B *e*, that its mechanical effect upon the scale-pan may equal one ounce. If a body weighing less than an ounce be placed in the scale, the end, B, of the beam will descend, and the opposite extremity rise until the first pair of notches, I., strike against their weight, L *l*; before the beam can move any farther, the weight must be lifted; but as its effect upon the scale is equal to one ounce, and the body is less than an ounce, the beam will remain with its notches in contact. If a body weighing more than one ounce, and less than two, be put into the scale, the first weight will be lifted, and the second pair of notches, II., will be brought into contact with the weight, M *m*, in which position the beam will rest. If a body weighing more than three ounces and less than four, be put into the scale, then the three weights, L *l*, M *m*, N *n*, will be raised one after the other, and the pair of notches, IV., will rest in contact with the fourth weight, P *p*, and so on. An index plate may be connected with the beam in any convenient manner; as, for example, by placing it at the end of the beam at R S, and making its edge concentric with the extremity of the beam; marks

being engraved opposite to the beam in each position, and numbers appended to them to indicate the corresponding weight: then, if any article is placed in the scale, the beam will immediately assume a position corresponding to its weight, by taking up (in the way just described), the required number of loose weights, and will thus show, with great rapidity, the weight of the article in ounces, pounds, or according to any other unit or series of weights that may have been assumed, and to which the separate loose weights have been made equivalent. And it is important to remark, that it will be evident that, according to my invention, the weights, when taken up by the beam, act for the time being, as if each weight were part of the beam itself, there being no swing or action of the weight with respect to the beam. Instead of engraving the weights upon the index plate, the price to be paid for such weight of the article may be engraved; as, for example, postage, if the machine be constructed to weigh letters, or both weight and price may be made to appear; but this I do not claim. I generally adjust the weight of the beam, so that it will require a weight equivalent to the first in the series, to raise it from its lowest position into contact with the first moveable weight, by which means one weight of the series will be saved; but this is not essential.

In the figures, as there are five moveable weights, and the beam is supposed to preponderate, as above described, it is evident, that any weight greater than six ounces, will raise the last weight, Q *q*; and that the weight of any article, if greater than six ounces, cannot be measured. Let a pair of notches, T *t*, be formed in any convenient part of the beam and such a weight be placed in them as will, together with the weight of the beam, exert a mechanical effort equal to six ounces on the scale-pan; then, any weight, greater than six ounces, and less than seven, will raise the beam into its second position, with the notches in contact with the first moveable weight; and, in like manner, the weight of any body less than twelve ounces, will now be measured by the same machine. By providing several of such additional weights, the scale, or range of weights that the machine is capable of measuring, may be extended at pleasure. I would remark that, to insure the perfect action of the balance, the line which joins the centres of motion, B and E, of the scale-pan and beam, should pass through the centres of gravity of every weight, when it lies in the beam notches, as well as through the centre of gravity of the beam itself.

The order in which the weights are raised, is indifferent, provided they be raised in succession; thus, the extreme weight, Q *q*, might be raised first, and so on. Also, the rack may be placed within the beam, so that the beam may act upon the extreme grooves, *a d*, fig. 3, of each weight, and the rack upon the intermediate ones, *c* and *b*; and various other changes may be made in the arrangement and form of the machine, which will readily suggest themselves to scale-makers and mechanics. I do not, therefore, confine myself to the precise form or arrangement shown.

I sometimes make a machine, in a form which is explained in fig. 4; C A B represents a scale-beam, of any usual form, of which A is the centre; and from the extremity, B, is to be suspended a scale-pan or other ordinary receptacle; from the opposite extremity of the beam, C, is suspended another scale pan, of which D E is a side view, and which is furnished with a link, *f g*, below, in the manner of the common Medhurst pan, by which it is prevented from swinging. A series of weights, *a b b d e f*, of the same form as fig. 3, are supported in a rack, attached to the fixed frame of the machine, and the two opposite sides of the suspended scale-pan, D E, have each a series of angular notches, every opposite pair of which lies below one of the weights; so that when the pan, D E, rises from the action of any article in the opposite scale-pan, these notches meet, and take up in succession as many of the weights as are required to counterbalance it, exactly in the same manner as in the machine first described. I have not thought it necessary to show the requisite framing to carry the fulcrum of the beam, and the rack which supports the weights in their proper places. In this form of machine, two or more pans may be placed one above the other, for the purpose of taking up these weights, or the pan which takes up these weights, may be made in various forms; also, the weights may be placed either transversely to the beam (as in the figure) or they may be parallel to it, or otherwise disposed; it being only essential that they shall be placed at a distance, horizontally and vertically, from each other, and properly to be taken in succession by the pan, and, when taken, to retain them from movement, in respect to the pan. I do not claim the principle of causing the scale-beam, or suspended frame of a balance, to raise weights in succession, various

contrivances for that purpose having been used before. But what I claim is, first, the mode of constructing weighing machines, wherein the beam is caused to take up successively a series of weights in such manner that, when taken up, each weight is so held, as to be without swing or action in respect to the beam. Secondly, I claim the mode of constructing weighing machines, whereby a series of weights are successively taken up, each being placed separate, and vertically, and horizontally, distant from each other by a scale, and wherein the weights will be retained, without swing or motion, in respect to the said scale."

POOLE'S PATENT AIR-PADDLES.

(*Abstract of Specification.*)

THE invention consists in obtaining power by means of an apparatus, the arrangement of which consists of a series of blades or surfaces, fixed in an oblique direction to an axis, which axis is made to revolve, and, consequently, to carry them round at any velocity required, the atmosphere acting as the point of resistance; whereby I am enabled to obtain a great power, which may be employed for propelling boats, carriages, &c.

First, the point of resistance will be found to be in the atmosphere, and that will be sufficient to produce the motion required. It will be seen hereafter, that the power will be found to be equally available in the water; but it is only when in operation in the atmosphere, that it is perfectly new in its application, and quite different from the others, which require the aid of the ground or water as a point of resistance, to obtain the same result.

To act successfully, the machine or apparatus should be completely surrounded with the atmosphere in which it is working. I will illustrate this by the wheels of a steam-boat, which are alternately plunged in the water and in the air; if they were wholly immersed in water, or wholly immersed in the air, they would not produce any desirable result. My apparatus, on the contrary, should be placed entirely in the air or in the water, to produce its proper effect; but when it is required to act in the water, the form and material of its construction should be regulated accordingly. It will be found as ineffective when working partly in the air and partly in the water, as the wheels of the steam-boat would be, by working in the atmosphere only; the essential principle of this power being wholly immersed in the matter, which acts as the point of resistance. The Archimedes screw acts upon this principle, but the construction of it is very different from this invention.

Again, it turns round on an axis parallel to the line of draft, in a similar manner to the position of the wheels of a steam-boat or a carriage, which makes a right angle with the line of motion.

The essential character of this invention is, the arrangement of a series of flat blades placed in oblique positions to the surfaces, which pass through the axis of the apparatus. These blades or surfaces may be made of metal, wood, or any suitable material; the obliquity of the positions may be varied from 1° to 89°, according to the power of wind you have to act against, whether it is fair or foul, or whether the apparatus is to be used in water. The number of these blades may be varied, from two to twelve, according to the size of the machine; they may be placed two or three together, if required. The size of these blades must depend upon the power required; they may be fixed together by any of the usual means. The axis on which these blades or surfaces are fixed, may be put in motion by a steam-engine or any other power, and the effect will be that the atmosphere, pressed against at the same time by the whole of these blades, will resist; and it forms the opposing medium of the pressure of each surface, the exact points of resistance, according to the extent and position, and, consequently, will become the resisting oblique surface, in relation to the blades which pass through the axis of the apparatus. Each surface being in the same position of obliquity, and pressing with force against the air, will cause a great resistance; the principle of the inclined plane will produce a perpetual pressure of the surfaces, which each of its sides will describe in the air, in a similar way to the Archimedes screw. These blades may be placed two or three together, meeting at the axis of the apparatus, and each surface will furnish an oblique force in relation to the axis, in the same number of degrees as the surfaces themselves, and the resisting air of the combination of the oblique blades. The axis of the machine will be in proportion to the size of the machine, to the number of the blades, and to the greater or less inclination of them, and to the rapidity with which the axis is put in motion.

This apparatus may be applied to move any description of vessel, either floating in the air or in the water. If it is to act in the water, the size of the blades must

be diminished, and the obliquity of them must be increased. This may be also applied for drawing carriages upon the railroads.

ELECTRICAL PHENOMENA.

At a late meeting of the *British Association*, the following paper was read by M. Schonbein on electrical phenomena:—

It is well known to electricians, that in certain electro-chemical decompositions a peculiar odour is evolved, very analogous to that produced by common electric sparks, or by the working of an ordinary electrical machine, in the air. M. Schonbein has undertaken a series of experiments, in order to ascertain the circumstances under which this electro-chemical odour is evolved, the causes which influence its production, and, if possible, the principle to which its appearance is to be attributed. This peculiar odour is evolved at the anode or positive surface, when certain aqueous solutions are decomposed by the passage of a voltaic current. The oxygen gas which is then evolved, has a strong and peculiar smell, which is perfectly similar to that which is always perceived when an electrical machine is worked, or sparks passed through the air. M. Schonbein has observed, that the odour is evolved on the decomposition of water, dilute sulphuric acid, solutions of phosphoric and nitric acid, potassa, and many oxysalts; dilute sulphuric acid yielding it in the greatest quantity; while no smell whatever was perceived on the decomposition of solutions of hydracids, chlorides, bromides, or iodides, which not only did not evolve it themselves, but by their presence, even in small quantity, prevented its evolution from solutions which would otherwise have produced it abundantly. He found, on collecting the oxygen gas evolved at the anode, from a solution capable of evolving the odour, that the odour might be preserved for some time, by enclosing the gas in well-stopped bottles. From the characters possessed by this oxygen, M. Schonbein was led to consider the odour due to the presence of a minute quantity of new and, hitherto, wholly unknown substance, of considerable importance in many natural phenomena; and he has, therefore, named it from its most evident character—ozone. Its properties are briefly as follows:—It is only evolved from solutions containing it, by perfectly clean electrodes of platinum or gold; while charcoal and the more oxidizable metals are unable to cause its appearance. It can only be obtained from a cold solution, as heat prevents its evolution. When a piece of one of the oxidizable metals, such as zinc, tin, iron, mercury, &c., or a few drops of solution of the protochloride of tin, or protosulphate of iron, are placed in a portion of oxygen impregnated with ozone, that peculiar substance is almost instantaneously absorbed, and the oxygen becomes inodorous. When perfectly clean and dry plates of gold or platinum are immersed in oxygen containing ozone, they acquire a negatively electric state of polarity; silver and copper also become thus electric, but in a far less degree than gold or platinum. The plates thus polarized retain their electric powers in air for a considerable time, but rapidly lose it when plunged into hydrogen gas, in which, if retained in a sufficient time, they acquire an opposite state, becoming positively polarized. M. Schonbein then compares these effects with those produced by the odorous matter peculiar to common electric sparks and brushes. When a perfectly clean and dry plate of gold or platinum is exposed to an electric brush issuing from a charged and conducting point, it becomes positively polarized, and the degree of polarity depends on the nature of the point and the time which the plate has been exposed to the influence of the brush issuing from it. He shows that the power is not due to the mere current of electricity escaping from the point, but to some substance produced or evolved by it; because if the point be moistened, the electricity still continues to be given off as a brush, but the power of polarizing the gold or platinum plates is lost. A plate thus charged is perfectly similar in its electrical powers to a plate charged or polarized by immersion in oxygen impregnated with ozone. Heat or exposure to hydrogen, which destroys or inverts the electricity of such a plate, exerts a precisely similar action on plates polarized by exposure to the brush; and, likewise, if the plates are not perfectly clean and dry, it is equally impossible to charge them, either by exposure to the brush, or by immersion in oxygen containing ozone. M. Schonbein supposes that there exists, both in the air and water, a very minute quantity of an electrolyte or compound substance, which, when decomposed by electricity, evolves, as one of its constituents, the peculiar odorous matter called ozone. He observes, that both from its electromotive power, and likewise from its strong affinity for metals, it is evidently similar to chlorine, bromine, and iodine. Its non-appearance, when water is decom-

posed by electrodes of the more oxidizable metals, he attributes to its entering immediately into combination with those metals; and he considers, that when the solution is heated, the affinity of the ozone for metals is so much increased, that it is even able to combine with gold and platinum, thus accounting for its disappearance when heated. By this theory, all the phenomena attendant on its evolution may be easily explained; and it hence becomes very interesting to search for traces of this widely-diffused substance. M. Schonbein considers, that the smell perceived whenever bodies are struck by lightning, is probably due to a small portion of ozone being set free, and relates a case of a church lately struck by lightning, which fell within his own observation, in which the surrounding buildings, to a considerable distance, were filled with a bluish vapour having a peculiar pungent odour. Even in this early stage of the inquiry, it will readily be seen, that many curious and unexplained phenomena might be accounted for, if the existence of the supposed electrolyte be proved. M. Schonbein proposes devoting all his leisure to the prosecution of this inquiry, in the details of which he is at present engaged.

MR. HEDGCOCK'S NEW SYSTEM OF ASTRONOMY.

In justice to the author, we insert his letter without addition or omission; but we must confess, that we see nothing in it to incline us to alter the opinion we at first expressed. In all our reviews, it is our chief endeavour to hold the scales of justice with rigid equity and impartiality, dealing censure or praise according to merit, to the most esteemed friend, as we do to the stranger. All authors are, more or less, enamoured of their productions; and though they may be candidly and honestly seeking for the truth, still they cannot help feeling much disappointment, if they find it in a direction different from that which their theories and surmises had indicated. It is more agreeable to us to concur with an author, than to contradict him; but we have a duty to perform, from which no consideration can dispense us. We do not exactly understand the promised reward of 10,000 acres of land; but although it is situated in the city of London, we advise our readers *not to build upon it.* Even if it really existed, its possession would not be so desirable as many may suppose; for riches and happiness are not always companions—do your duty in that state of life into which it has pleased God to call you; endeavour to deserve the affection of your friends, and the esteem of good men, and you will possess that inestimable blessing—*a contented mind*—which is more valuable than all the acres in the world.

To the Editor of the Mechanic and Chemist.

Sir,—I am extremely obliged by your review of "Multum in Parvo;" but, with respect to the reviewer's opinion, founded, as all our notions have been, upon the Newtonian philosophy, I cannot but forgive the first ebullition of his ideas, as I have found hundreds of the same opinion; and who have invariably been convinced of the correctness of my views. Mark! practical navigators, not theorists. I shall not dwell at present upon the first shot of the enemy, but content myself by proposing for your friend a more perfect analysis of the third plate, and the whole description of both chapters, of 4th and 5th, with the notes therein attached; and if he can find, or any one, a very trifling hint *therein contained*, to obtain the distance, "which I can at any moment produce," I will reward him with shares of lands worth a considerable amount in the city of London, say 10,000 acres. Independently of this distance, the longitude therein contained can be as well ascertained equally at 95,000,000 or 19,000 miles, and all astronomical calculations, as well by the latter as the former; only in the Newtonian system, the whole of the stars ought to be hidden during the time of the earth's progress throughout its orbit, to produce the seasons, &c.; whereas, in the author's proposition, the whole of the stars are the constant proofs of its correctness. We here raise or depress the altitude of the Pole Star for 100 years only a few seconds per annum in any latitude north, and only its horizontal motion since 1820 to 1840 eleven seconds more westward of the true north; and prior to that time, viz., from 1520 to 1820, eleven seconds more eastward per annum, proving a horizontal motion of the earth in a period of 600 years. We are now upon the same position as at the beginning of the Christian era. The year 1200 was remarkable for the great light of Christianity, and building of churches; and about 600 years before, was the commencement of prosperity of the Roman empire; 600 years before was about the time of Solomon's glory—building the Temple, &c.; 600 years before was about the time the Pyramids of Egypt were built, whose

sides should have the same bearing now to the sun at noon, south by west, and Pole Star, north by east, per compass; and which difference from S S W ¼ W at London, being doubled, will produce nearly their longitude east of this meridian. This horizontal motion, *hitherto undiscovered*, contains such a mass of truth, that I wonder how any one, having the least pretensions to scepticism, could have overlooked so important a subject; and 600 years prior to 3600 years, would bring us to the precise time of the great deluge of Noah, as therein stated. Be pleased to put in the method I have sent you on eclipses as early as convenient, and I doubt not you will do me the justice to insert the foregoing, or my ship will be sunk without a shot on my part.

I remain yours, &c.

THOMAS HEDGCOCK, R. N.

7, South Lambeth,
Oct. 5, 1840.

ANDRAUD'S ATMOSPHERIC ENGINE.

THE application of compressed atmospheric air as a substitute for steam, has, for several years past, occupied the attention of the learned, especially in France; and it will be seen by the following extract from a Paris letter, that great progress has been made since we last called the attention of our readers to the subject. It must be recollected, that though the vessel, which is substituted for the boiler in a steam-engine, is required to sustain a much higher pressure than could with prudence be applied to the latter, yet the danger of bursting is no ways increased; for the air-vessel, not being exposed to heat, or any other cause of deterioration, will always retain the same strength it possesses at the time of proving.

Several distinguished engineers and other scientific men attended on Saturday to witness a series of experiments on compressed air, at the late establishment of M. Perrier and Co., at Chaillot. The inventer of the various new and ingenious modes of applying this power, M. Andraud, a gentleman well known in the scientific and literary world, began by exhibiting a small carriage, which was set in motion by compressed air on a small railway laid down for the purpose. This carriage was moved up and down several times at the rate of about twenty-five miles an hour. The air, compressed only to about twenty-five atmospheres, which is little more than one third of the power to which it can be compressed without danger of explosion, is contained in a proof cylinder or reservoir, which supplies the pistons in the same way as for a steam locomotive. M. Andraud states, that two of these cylinders are sufficient for the supply of a locomotive for several miles on a railway; and as air can be compressed almost without expense, wherever there is a stream or even a windmill to work the machinery, fresh charged cylinders can be kept ready at stations and applied to the locomotive, this being the work of only one minute. The improvement in M. Andraud's air locomotive, on all others which have been invented, is in the application of a regulator, by which the air is supplied with unfailing regularity and certainty, and which is under the full control of the engineer, and in the mode of dilating the air by heat, so as to cause great economy. In dilating air it is necessary, for the purposes of locomotion, that it should be done very rapidly, for otherwise the speed cannot be kept up. It cannot be dilated in the cylinder or reservoir without great danger of explosion; and, by the ordinary process, only the external surface of the air immediately exposed to the action of heat, is rapidly dilated; the internal molecules—air being a bad conductor—requiring great time for dilation. M. Andraud gets rid of all this difficulty, by passing the air through a very long spiral tube immersed in boiling lead, and in this way the whole is dilated in the twelfth part of a second; and a reservoir of air thus dilated, gives 5000 strokes of the piston, whereas the same quantity of air undilated gives only 2200. Another of the experiments was with an air-cannon. Balls were thrown from it which, at a distance of 250 yards, broke in the roof of a building, and lodged with great force in a wall, although the air was compressed to only twenty atmospheres. M. Andraud proposes, that batteries in fortified towns shall be worked by compressed air instead of powder; the expense, where there is water power or wind to compress the air, being, according to M. Poucelit, only one-seventy-fifth of that of powder, and, if compressed by a steam-engine, about one-fiftieth. M. Andraud imagines, that field artillery may be worked in the same manner, as the horses, in drawing the guns to the field, would, by the motion of the wheels, fill all the reservoirs necessary for a long battle. The next experiment was on the power of compressed air in raising water, either for the supply of towns or for the draining of

marshes, mines, &c. By a very small apparatus, a column of water was thrown to a height of seventy-five feet.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, October 21, R. H. Semple, Esq., on the Metals. Friday, October 23, Rev. William Vidler, on the Natural History of the Carnivorous Mammalia. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Tuesday, Oct. 20, Election of Officers. At half-past eight.

Franklin Mutual Instruction Society, Halfmoon Alley, Lower Whitecross Street.—Tuesday, October 20, Rev. J. C. Means, on the History of France. At half-past eight o'clock.

Chemical and Philosophical Society, No. 241, High Street, Shoreditch.—Wednesday, October 21, Mr. Thomas, on Sulphur. At half-past eight precisely.

QUERIES.

The best and quickest way of dissolving Prussian blue without injuring the colour?

W. R. T.

The best method of preserving animal and vegetable substances.

ANSWERS TO QUERIES.

To Stain Wood of a Mahogany Colour.—Take one pound of log-wood, boil it in four quarts of water; add a double handful of walnut-peeling; boil it up again; take out the chips, and add a pint of the best vinegar, and it will be fit for use.

Another.—Take some linseed oil, and mix with it a little brown umber in powder, and oil of wood; a little red lead may be added. G. T.

Electrical Machine.—I have made an electrical machine out of a turned cylinder of baked wood, covered with shell-lac; the rubbers are of flannel: it answers completely, beyond my expectation.

MANIPULATOR.

1. *What is the best Test for Lime in Water?*—Carbonic acid, which precipitates the lime in the state of a carbonate. It may be done by blowing through a tube into the water. The carbonic acid contained in the air we respire, is quite a sufficient test.

2. *How much Lime will it take to Saturate Water?*—About half-a-pound to twelve pints. Each ounce of the solution contains one grain of lime.

3. *What is the best Test for Carbonic Acid Gas in a very strong Solution of Crystal Soda, or a Solution of Crystal Soda and Lime?*—Diluted sulphuric acid is the best that can be used; the carbonic acid is expelled with an effervescence. Tartaric, nitric, muriatic acids, will do almost as well. The best way is, to put a little of the solution in a wine-glass, and add the acid to it. The same plan will apply to a solution of soda and lime.

W. GROOM.

TO CORRESPONDENTS.

A Correspondent *asks*, "*Whether the heat produced by the sun's rays may not be caused by the extreme velocity with which they move through our atmosphere, and through the material ether with which space is allowed to be filled; as we well know that light and heat can be produced from friction of matter; and the sun's rays being allowed to be material, and the medium through which they pass being allowed to be so also, the supposition does not appear, I think, improbable?*"—*That light is a real existence, is proved by its motion, and its action on bodies; but it has never been discovered to possess the ordinary attributes of matter—gravity, inertia, or extension; neither is its free passage through hard and compact transparent bodies easily reconciled with our notions of* material *existence. Until a more perfect knowledge of the nature and operation of electricity shall have unveiled half the mysteries of nature, we must be content, by diligent inquiry and experiment, to discover and establish isolated facts, where the known laws of nature are inadequate to explain the phenomena. A great deal might be said in support of the theory suggested by our correspondent; but our present object is only to call the attention of our scientific readers to this very interesting subject.*

J. Paterson's *centrifugal escapement will appear when the engravings are ready.*

A Subscriber (Cheltenham) *will see a description of the thermo-barometer in a forthcoming Number. Pure azote should be employed, that gas being perfectly inert.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by DOUDNEY & SCRYMGOUR (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 116, NEW SERIES. | SATURDAY, OCT. 24, 1840. PRICE ONE PENNY. | No. 237, OLD SERIES.

THE ADVERTISING WHIRLIGIG.

City Press, 1, Long Lane: Doudney and Scrymgour.

THE ADVERTISING WHIRLIGIG.

VANS and placards being the order of the day, we have this week to notice a great novelty in this mode of advertising, which, we feel assured, will attract the attention of the public. As our artist has carried out the design so well, we have little to say; but that the placards on this van will have a great circulation, as it will be constantly "*going round.*"

DESCRIPTION OF A MUSICAL BOX.

THE musical snuff-box, which is, comparatively speaking, of modern invention, is universally admired for the liquid sweetness of its tones, the great range of notes embraced by it, and the rich harmonies resulting from the sounding of several notes simultaneously; but the principle on which this little instrument acts, is not very generally known, therefore we will devote a short space to this subject. Metallic springs, when fixed at one end, and free to vibrate at the other, will yield notes which vary in pitch according to the dimensions of the spring. If two springs be of equal width and thickness, the shorter of the two will yield the higher note: if the length of the two be equal, but the thickness be different, the thicker of the two will yield the higher note. By a judicious management, therefore, of the length, thickness, and width of a series of springs, several octaves may be produced, of which all the semitones may be accurately filled up. Such is the case in a musical snuff-box. On inspecting it, we shall find a series of small metallic springs ranged side by side, in the order of their pitch; the lowest being at one end, and the most acute at the other. By filing these springs, or by loading them with small pieces of metal, attached to their under surfaces, as the case may be, the whole series is accurately attuned, and the means must now be devised for setting them into a state of vibration.

This is effected by means of small pins, which are fixed on the surface of a revolving barrel. The barrel is placed lengthwise, opposite to the ends of the springs, but a small distance from them; so that if projections were not inserted in the barrel, the springs would remain untouched. These projecting pins stand out from the barrel, just far enough to catch against the springs, set them into vibration, and then liberate them again. It might be supposed, that directly the disturbing force is removed, the vibrations of the springs, and the sounds resulting from these vibrations, would cease. But all vibrating bodies make a number of vibrations after the moving force is removed. The pendulum of a clock, the chandelier suspended from a ceiling, &c., are instances of this. But the rapidity of these vibrations during the production of a musical note is so great, as almost to exceed belief, were it not attested by well-conducted experiments. For instance, the note which is called the tenor C, which is the middle C of the pianoforte, is due to a velocity of vibrations of 256 in a second; that is, when a metallic spring, or the wire of a pianoforte, or any other musical instrument, is producing the tenor C, it is vibrating 256 times in a second; and as the pitch of the note becomes more elevated, so does the rapidity of the vibrations increase. It is no wonder, therefore, that we cannot see the vibrations of the springs of the musical snuff-box. The revolving motion of the barrel is effected by similar contrivances to those which produce the motion of the wheels of a watch. A steel spring is coiled up by means of a key which is applied to it; and as its elastic tension causes it to unwind, it sets in motion a ratchet wheel, which acts upon another wheel attached to the barrel, by which the latter is made to revolve, so long as the coiled spring is unwinding itself. The motion of the barrel, then, is wholly due to mechanical arrangements similar to those of a watch.

Having now got the vibrating springs and the revolving barrel, it remains to describe how the pins are arranged on the surface of the barrel, so as to touch those springs, and those only necessary to produce a given tune.

Suppose that the maker had chosen Mozart's air, "Life let us cherish," and wished to arrange it on the barrel in the key of G. The first note is a dotted crotchet on the note B; he therefore places a pin in that circle which is opposite to the spring yielding the note B: this we will call the circle B. The next note is C; but as the first note is a dotted crotchet (equal in duration to three quavers), the second pin must be so placed, that the barrel shall revolve a short distance between the contact of the first and second pins with their respective springs; by which means a proper time will elapse between the sound of the B and of the following C. The next note is B, and another pin is inserted in the circle B; but as the preceding note, C, has only the duration of a quaver, the interval between the second and third notes must be only one-third as long as between the first and second notes; such a position is, therefore, chosen in the cir-

cle B, that that note shall be sounded very quickly after the preceding C. The fourth note is another C, which, on account of the preceding B being also a quaver, is pinned so as to sound after the same length of interval as in the last case. Thus doth he proceed, moving along the barrel to produce difference of pitch, and round the barrel to produce difference of time in the notes produced. In the above air, the B occurs four times; between the striking of the first and second, there is an interval equal to four quavers; between the second and third, fourteen quavers; and between the third and fourth, two quavers. If, therefore, we were to examine the circle of pins which strike the spring B, we should find those four pins at the relative distances of four, fourteen, and two, from one another. By a similar examination, we could find the relative distances of the pins in all the repetitions of the notes G, A, C, and D, in the above examples; but what has been said will be sufficient. The rapidity of the motion of the barrel, and the distances of the pins upon its surface, are so regulated, that a tune is played exactly through, either once or twice, during one revolution of the barrel; else, were not this the case, the pins necessary to produce the final notes of a tune would interfere with those necessary for its commencement. It is generally known, that the greater number of musical snuff-boxes play two tunes each; to effect this, the series of circles of pins belonging to one tune, are interposed between those belonging to the other; that is, the B circle of one is a little on one side of the B circle of the other; and so on with other notes. Now in order that one series of pins may remain inactive, while the other series is striking the requisite springs, the ends of the springs are brought up very narrow, so as to leave a space between them. When the pins of one tune are striking against the springs, the pins of the other pass between the springs without touching them. When a change from one tune to the other is desired, the barrel is, by means of a little mechanism (which is moved by a stud on the outside of the box), shifted a little onwards, in the direction of its length, and to such a distance, that those pins which before acted on the springs, now pass between them; while those, which were before inactive, assume a position in which they can strike the springs. But it must be borne in mind, that the performance is not confined to one note at a time; there is a rich harmonized combination of notes all playing simultaneously, forming tenor and bass, in all their variety and beauty. The person who fixes the pins must, therefore, either be a musician of some skill, or must be furnished with a copy of a sheet of music properly arranged.

E. L.

[The foregoing description is intended merely for the information of the general reader. We are in possession of some valuable practical secrets relating to the manufacture and management of these instruments, and it is our intention shortly to publish them. There are some mistakes in the above communication, which we must take the liberty of rectifying:—The apparatus which regulates the motion of the barrel, is not, as our correspondent states, on the principle of a watch; it is a worm and fly, which may easily be seen and understood. The pins do not follow each other upon the same circle as he describes, but each successive note of the same tone is inserted in a different circle from the preceding one, whenever, as in the above example, they recur at a less interval than about one-fiftieth of a revolution of a small barrel, in the highest part of the scale, and one-fifteenth in the bass. If the pins were placed, as our correspondent describes, the springs would fall from one pin on to another, without producing any musical sound. Even in the small snuff-boxes, eight or ten springs tuned to the same note, are required for the execution of passages in which the same note is repeated in rapid succession. —ED.]

LONDON JOURNEYMEN'S TRADES' HALL.

THE Editor of the "Mechanic and Chemist," with his usual kindness, will aid the cause of temperance among London operatives, by giving publicity to a few words to the *working men of London*.

The absence of a Trades' Hall in London has created an evil which painfully affects your reputation, and retards your welfare—the *public-house meeting!*

Drunkenness, ignorance, want, and misery, are its demoralizing effects in individuals; and in societies, interruption of business, destruction of deliberative judgment, and a waste of funds;—a combined host against the rights of labour!

It is time to abolish this evil—you are equal to this great work. It is never too late to erect a Trades' Hall, to present in the metropolis a *practical* "Mechanics' Institution," on a magnificent scale; the noblest exhibition of your wisdom, pra-

dence, and energy:—the trades of London under one roof—a mighty pillar of strength against oppression!

The morality of a Trades' Hall justifies its immediate establishment by the united operatives of London. What is its expense among you, but as a drop of water in the ocean? Do you love economy? Do you attach any importance to the intellectual struggle for your social and political improvement? Do you enjoy innocent amusements, the festive scenes which mutualize your hearts to one another? Show it by a Trades' Hall of your own! The moral influence of its interior will increase your political importance.

In your several trades, then, discuss seriously the practicability of such an erection; by shares at 1*l*. each, you may easily dignify London with a Trades' Hall; you have union, determination, and judgment, to carry out this important project.

We exhort you to consider the position you will take in this important matter, your prompt decision in its favour is highly essential:—an extensive source of moral and social improvement hangs on the declaration of your will.

London claims a Trades' Hall! Brethren! shall it now be built?

Wm. Farren, Sec.

Trades' Hall Office, 16, Old Bailey,
October 14, 1840.

[That a considerable portion of the working population of this country is in a state of lamentable uneasiness and distress, is, unhappily, too apparent to be denied; and, considering the moral influence of instruction and the more direct advantages derived from temperance and economy, to rank among the most certain and efficacious remedies which existing circumstances will allow, we recommend the working men of the metropolis to respond to the call, and, by their united efforts, to carry into effect the project of erecting a Trades' Hall: but while we tender this advice, we again warn them of the dangers which always attend political broils. We do not wish to contract the bounds of their knowledge, but rather to extend them, so that they may not become the victims of designing demagogues. If men would but calmly look at past and present events, they would perceive that every nation upon earth is continually approximating towards a state of equality with the rest—not political or military equality, but equality of commercial prosperity, popular instruction, and civil institutions, founded upon principles of equity and justice to all. There are, indeed, some exceptions, where this progress is arrested by peculiar local circumstances; Ireland is a striking example of the ruinous effects of the misguided energies of a people. If that unhappy country could be delivered from the influence of those elements of discord and perturbation, which destroy all confidence, and dry up every source of prosperity; if manufactures were established, adapted to the capacity of the ill-instructed population, it would soon be found that their habits of extreme frugality would enable them to live upon very low wages, and produce articles which would be bought in richer countries—thus laying the foundation of commercial prosperity. From labourers would then spring up artists; from artists would arise masters, and masters would become merchants; and when the overflowing of richer nations had produced an equilibrium of wealth, a reciprocal circulation of commerce would ensue, regulated by the respective produce and wants of the trading countries. There are, however, certain natural advantages which one country possesses over another; and the country we live in is happily distinguished, above all others, by its advantageous geographical position; protected by the sea at every point from hostile invasion; by its highly productive and fertile soil; and, not least, by its inexhaustible treasures in the finest coals in the world. Yet, notwithstanding these and other advantages, distress and misery prevail among great numbers of the working classes, and no remedy is discovered. One cause is, undoubtedly, the transition from manual labour to machinery; but time will regulate the supply of labour to the exigence of the new system: many other causes of distress may be discovered or conjectured, and various modes of relief suggested; but we want that sound practical remedy, which must be sought in conjunction with experienced practical men, and the sufferers themselves. Let, then, a Trades' Hall be erected in London, where the journeymen of the metropolis may assemble and discuss their interests, negotiate with their employers, establish salutary bye-laws, and, above all, facilitate the means of obtaining useful instruction; but let them beware of political quack spouters; there is not one, from Smithfield to the Bull-ring, that possesses either wisdom or virtue to give good advice; they constantly seek to render men blind to their real interests, and entice them to the pursuit of phantoms and cacodemons. One says, "Let the Bank resume the issue of paper currency; that will raise the prices of commodities, and also increase the

amount of wages." Another says, "Abolish the Corn Laws; that will lower the prices of commodities and the rates of wages." Another recommends that a general election for members of Parliament should take place every year, and everybody become voters. Others have actually advised, that all the workmen in the kingdom should leave their occupations for a whole month together, for the purpose of injuring the general trade of the country, and their employers in particular. Another numerous class insist upon the abolition of Christian religion, and the destruction of all private property, with no punishment to restrain crime, and no reward to stimulate merit; and these are not more wicked than those who recommend and practise the burning of hay-stacks, and setting houses on fire. Englishmen! how long will you be duped by such sorry doctors?—ED.]

A VISIT TO A POT MANUFACTORY.

No. I.

ONE fine morning in July, my companion proposed a visit to the Potteries to see the process of making pots; I had been there several times, but to gratify his wish I agreed, and accordingly, after breakfast, off we started. The morning was fine, and a delightful hour's walk brought us to that region of smoke—the Potteries. A person may know he is near the Potteries, by the large conical buildings, called *hovels* (which surround the ovens—places where the articles are baked or *fired*), which are continually (or nearly so when trade is brisk) vomiting forth dense clouds of thick black smoke.

After passing along several streets, we arrived at the manufactory we proposed visiting. We engaged the bailiff or foreman as our guide. It is but justice to remark, that the manufacturers, together with their bailiffs or foremen, are a very obliging people. I have tried them several times, and I always found them ready at any time to oblige.

The preparing of the clay is, of course, the first step. The chief ingredients used in making all sorts of pots, are flint and clay. The first of these is called by chemists silica, the latter alumina. The clay, called by potters *ball clay*, is brought to them from Dorsetshire and Devonshire, by the canal. Part of the flint is manufactured at the various water-mills which surround the neighbourhood, and is brought to the Potteries in large white barrels, placed upon wheels, and drawn by horses. Some manufacturers work their flint-mills with a steam-engine, and prepare their flint on the manufactory. Another sort of clay, found in Cornwall, called *china clay*, is much used in the manufacture of finer sorts of pots; besides these, there are several other substances used in the composition of different kinds of pottery.

The clay before mentioned is called *ball clay*, from its being in balls or lumps; it is broke in pieces and put into a trough, called the *rough pot*; here water is poured upon it, and the whole is agitated until it is brought to the consistence of cream. This operation is called *blunging*. This mixture is poured into a large cistern through a sieve; here the flint is mixed with it. The clay and flint should be of a certain specific gravity previous to being mixed. When a pint measure of clay weighs twenty-four ounces, and one of flint thirty-two ounces, it is then held to be of the proper consistence for mixing. The exact proportion in which the flint and clay are mixed, cannot be given, as each manufacturer has his own receipt, which, considering it the best, he tries to keep secret. The following are mentioned by writers on the art of potting, as receipts for the composition of the clay:—

Fourteen measures of flint, added to eighteen measures of clay.

	No. 1.	No. 2.
Porcelain clay ..	100 parts	100 parts
Flint	9	9
Gypsum........	4	5
Broken porcelain	9	8

The last two receipts are for the composition of finer sorts of pottery.

This mixture of clay and flint in a fluid state is called *slip*, and, after again passing through the sieve, is mixed with the pieces of clay cut of the different sorts of ware by the turner (whom we shall mention in his proper place) and others, called *shavings*. These shavings, it must be understood, are all of the same composition as the mixture into which they are put. This mixture is again sifted, after which it is pumped or laded into a sort of trough, formed of fire bricks, called the *slip-kiln*. A fire is placed at one end, and the kiln is heated by flues passing under its whole length. In order to have the kiln heated equally in all its parts, the floor should decrease in thickness from the fire to the other end. Here the fluid is made to boil, and the mass is frequently stirred, in order that one part may not become hard, while the other remains soft. Clay is a

bad conductor of heat, and were it not repeatedly stirred, that part in contact with the bricks would become very hard, while the upper parts would remain in a fluid state. Besides, flint is specifically heavier than clay; therefore, were it not frequently agitated, the flint would sink to the bottom, and thereby render the composition

FIG. 1.

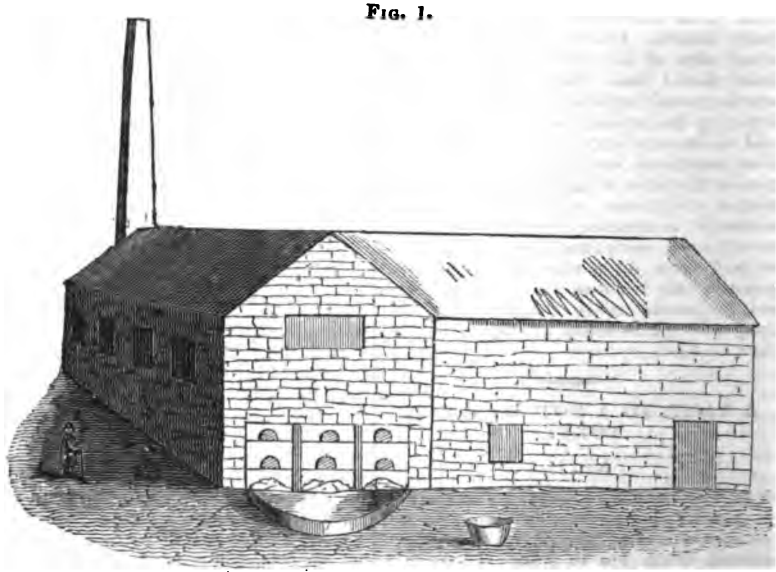
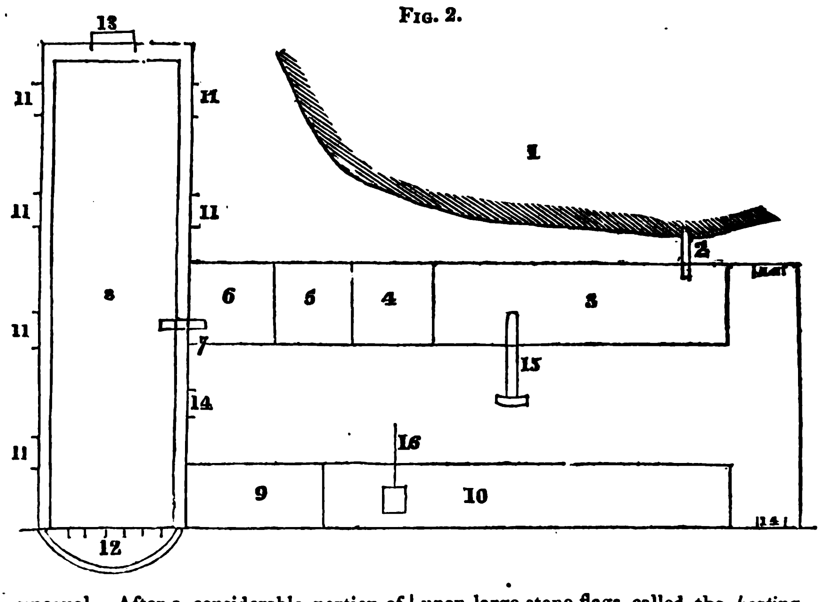


FIG. 2.



unequal. After a considerable portion of its watery particles have been evaporated, it is removed from the slip-kiln, and placed upon large stone flags, called the *beating-board*. Here it is well tempered, by being beaten with large wooden hammers; it is

next cut into pieces with a sort of spade, called a *paddle*, and these pieces are thrown upon the mass with all the strength of the workmen. This laborious operation is continued for a considerable length of time, its object being to expel the air bubbles with which the clay has been filled during the process of evaporation, and to bring the mass into as perfect a state of solidity as possible. It is then left for a few days; for, by letting it rest awhile, it becomes more intimately united than can ever be effected by mechanical means.

The persons who perform these operations are called slip-makers, and the place in which they are performed is called the slip-house, the first place we visited.

In our next we will proceed to the formation of the utensils by the thrower, &c.

Figs. 1 and 2 represent an elevation and a ground plan of a slip-house; 1 (fig. 2), a pool of water; 2, a trough for conveying the water into the rough-pot; 3, the rough-pot; 4, 5, 6, sifting tubs; 7, a trough for conveying the slip on the slip-kiln; 8, the slip-kiln; 9, the flint-ark; 10, the beating-board; 11, 11, 11, 11, 11, 11, are apertures for the escape of the vapour which rises from the slip during evaporation; 12, fire-places; 13, the chimney; 14, 14, 14, doors; 15, a blunger, used in agitating the clay in the rough-pot; 16, a paddle.

HOLDSWORTH'S PATENT PROCESS FOR PRESERVING WOOD FROM DECAY.

(Abstract of Specification.)

THE object of this invention is to preserve wood or timber from decay, by immersing it in certain liquids, having the following properties—namely, of receiving a temperature under common atmospheric pressure, capable of charring or searing the surface of wood exposed to their action, and of concreting or hardening more or less by subsequent cooling, so as to remain in those pores into which they have previously entered, as well as to cover the surface of the wood, and thus preserve it from the injurious effects of air and moisture.

The substances that may be employed for this purpose, are, first, natural bitumen, solid or liquid, such as asphaltum or petrolium. Second, the tarry matter produced in the distillation of coal, whether such matter is in its usual state of liquidity, or in that of its products, when it has been subsequently inspissated. Third, common or wood-tar, as well as the products into which it is converted by distillation—namely, common pitch and essential oil of tar. Fourth, turpentine and the products into which it is converted by distillation—namely, oil of turpentine and common resin. Fifth, tallow and other fixed oils or fats of animal or vegetable origin. All the above substances, when at their respective boiling temperatures, are much hotter than boiling water, and therefore any one of them used by itself for a sufficient length of time, might produce on wood, immersed in it when boiling, the searing or charring, which is one of the effects contemplated by this my invention. But as some of them are of too thick a consistence when melted, and as others (being liquid at common temperatures) will not concrete sufficiently in the pores of wood, I find it advantageous to mix them in various suitable proportions. That mixture which I have found to answer my purpose best, is composed in the following manner: I put into an iron pan or suitable vessel, one gallon, or any number of gallons, of wood-tar, and dissolve therein, by the application of a gentle heat, common, that is, wood-pitch, in the proportion of two pounds to every gallon of tar. I then add tallow, in the proportion of two pounds to every gallon of tar; and when this has likewise been melted and well mixed, I add coal-tar, in the proportion of half-a-gallon for every gallon of wood-tar. The above mixture may be made, either in the same vessels as are used for the subsequent process, or in a separate one, and when local circumstances will permit, I prefer to make the mixture in one vessel, and to apply it to the wood in another. The shape of the former of these vessels is immaterial, provided there is a fire-place, by means of which a moderate degree of heat can be given to the mixture contained in such vessel. The latter vessel, being that in which the wood is to be placed, is most convenient, if made of a quadrangular form, the proportions of which will depend on the size and shape of the timber to be operated on. It ought to have bars placed inside, an inch or two above the bottom, for the timber to rest on. It should have a convenient fire-place and a covering with an opening, wide enough to allow the timber to be readily put in and taken out, and should likewise have an ascending pipe or pipes, for the purpose of conveying away the inflammable vapour which rises from the mixture or liquid when heated; in order to diminish, as much as may be, the risk of fire, as well as for the purpose of condensing

and collecting (if advisable) such vapour or essential oil.

The timber, which I prefer to be previously in a seasoned or dry state, is to be brought to the form in which it is intended to be employed, is to be arranged on the bars within the boiler, and the liquid mixture above described, if made in a separate vessel, is then to be poured in; the fire is thus to be urged as quickly as consistent with prudence, and it will be found, as the heat of the liquid increases, that bubbles arise from the immersed timber; so long as the temperature is less than that of boiling water, such bubbles will be little else than common air; but as the temperature increases, the moisture contained in all timber, even in that which has been seasoned, will be converted into steam or vapour, and will thus not only itself escape out of the timber, but will also drive out much air, and thus allow the preserving moisture to penetrate the deeper. The use to which the timber is afterwards to be applied, as well as its thickness, regulates the temperature of the mixture, and the length of time during which the timber is to remain immersed; no specific direction, therefore, can be given applicable to all cases; but, as a general rule, it may be observed, that those pieces which are required to be flexible (such as the planks for ships' sides), require a temperature ranging from 212° to 220°, and generally a shorter time for immersion than those pieces of which the frame of a ship is composed, which require the mixture to be raised to its boiling point.

The wood, when taken out of the hot liquid, should be placed in a warm stove, to drain more or less, according to its intended use, and may then either be employed while still warm, or may be kept until the liquid has hardened on its surface.

George Cruikshank's Earliest Studies.—The gallery in which George first studied his art, was the tap-room of a low public house, in one of the dark, dirty, narrow lanes which branch off from one of the great thoroughfares towards the Thames. And where could he have found a more fitting place? Where could he have met with more appropriate characters? for the house was frequented, to the exclusion of everybody else, by Irish coalheavers, hodmen, dustmen, scavengers, and so forth. It was just the place in which to witness the lowest of low life in all its grotesqueness and drollery. And here I may remark, that it was George's etchings illustrative of low life in "Mornings at Bow Street" and "Life in London," that first brought him into general notice.—*Portraits of Public Characters, by the Author of "Random Recollections."*

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, October 28, R. H. Semple, Esq., on the Metals. Friday, October 30, Rev. William Vidler, on the Natural History of the Carnivorous Mammalia. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, Oct. 29, S. Preston, Esq., on Pneumatics. At half-past eight.

Franklin Mutual Instruction Society, Halfmoon Alley, Lower Whitecross Street.—Tuesday, October 27, Rev. J. C. Means, on the History of France. At half-past eight o'clock.

Chemical and Philosophical Society, No. 241, High Street, Shoreditch.—Wednesday, October 28, Mr. Hathway, on Water and its Elements. At half-past eight precisely.

QUERIES.

1. A description of the different pipes in hand organs with their dimensions, also a scale for making them? 2. How to make Pyropherous?

R. P. G.

What is the specific gravity of cast iron when it is in a state of fusion and the manner of finding it? How to turn a cube in a lathe?

E. Ledger.

TO CORRESPONDENTS.

Mr. J. Knowles *will find a letter addressed to him at our office.*

W. Foster.—*We shall be very glad to see the book upon algebra; it has not been delivered.*

H. W. M.—*The process said to have been discovered for destroying letters in a short time after they are written, is, we hope, and believe, still in the land of Utopia; should it be accomplished, we should consider it the duty of all who hold any communion with the public, to expose the fraud, and endeavour to devise a means for frustrating its object. Our correspondent may rest assured that the "Mechanic" will never wilfully publish anything injurious in its tendency; and if he refers to our observations on the process of destroying letters, he will find that we were very far from encouraging the invention.*

Andi.—*The nitrate of silver is silver dissolved in nitric acid; gold is dissolved in nitro-muriatic acid; comp. nitric acid, 2; muriatic acid, 1.*

G. S. I.—*The substances he mentions, do not possess the properties attributed to them by some persons; it is a superstitious notion, entirely unfounded in truth.*

London: Printed at "The City Press," 1, Long Lane, Aldersgate, by Doudney & Scrymgour (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. Berger, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

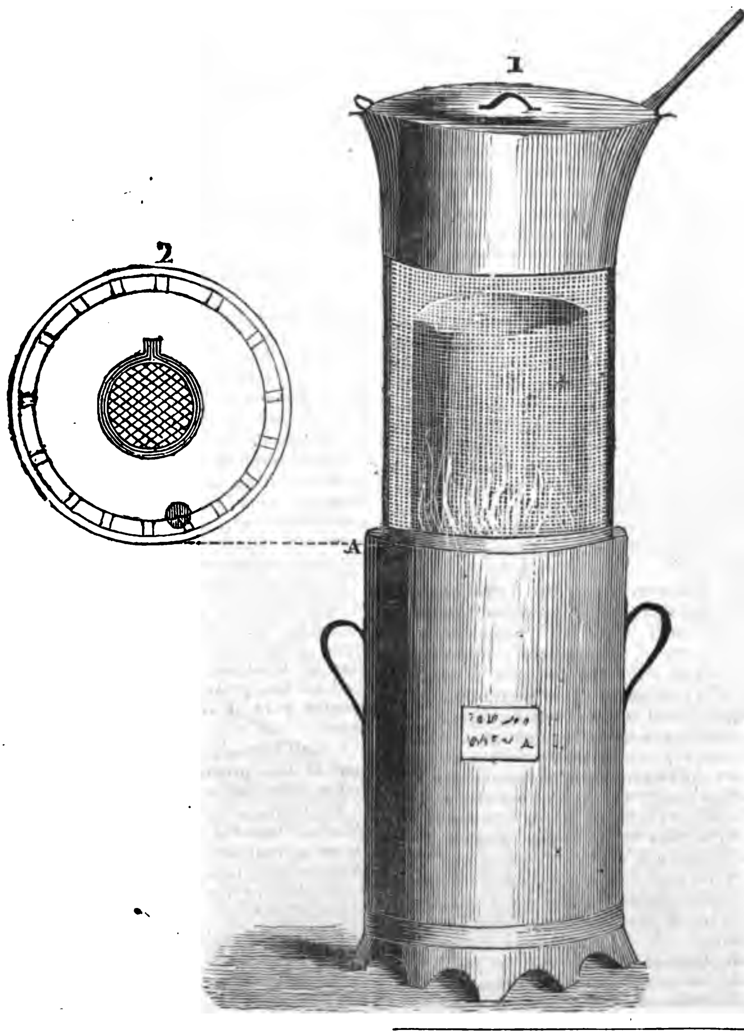
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 117, NEW SERIES. | SATURDAY, OCT. 31, 1840. PRICE ONE PENNY. | No. 238, OLD SERIES.

PIESSE'S AEROSTATIC COOKING LAMP.



 City Press, 1, Long Lane: Doudney and Scrymgour

PIESSE'S AEROSTATIC COOKING LAMP.

(See Engraving, front page.)

The present mode of heating liquids (water, coffee, &c.) in a balloon is very imperfect, requiring cumbersome apparatus, which gives great trouble to put in operation. It is accomplished by pouring water on unslacked lime in an appropriate vessel; a stoneware bottle, or any utensil made to contain liquids, is then buried in the lime. The heat evolved from the water on its passing from the liquid to the solid state in its union with the lime, is absorbed by the coffee, &c., and thus it becomes hot. Every operation requires a fresh portion of lime and water. When Mr. Green took his memorable trip to Nassau, one of his fellow-travellers, in emptying out the slacked lime, let fall one of the most important parts of this apparatus into the sea; and thus these gentlemen, who were *up* all night, and sitting in a damp atmosphere at a temperature below freezing, were prematurely debarred from taking anything hot to warm their nearly-frozen noses.

Description of Engraving.

Fig. 1 represents an apparatus to remedy these evils, and to obtain a heat sufficient even to boil a potatoe, &c.—a great desideratum in a protracted voyage; for instance, the anticipated one across the Atlantic. It consists simply of an argand lamp, trimmed with alcohol or methylene (i. e. pyroxlic spirit); the latter would be preferred on account of its cheapness), surmounted with a wire gauze, such as envelops the flame in the Davy lamp; on the top of this is a ring to support a saucepan, &c.

Fig. 2 is a section of fig. 1, taken at A. Every aperture which supplies the flame with air must be carefully provided with a diaphragm of wire gauze. When it is intended to light the lamp, a small portion of a mixture of equal parts of chlorate of potassa and sugar is put on the top of the wick; the glass and gauze are then put on a piece of twine, with one end dipped in sulphuric acid, previously put through one of the meshes of the gauze; it is then made to touch the mixture, which causes it to ignite instantly, and this lights the spirit. Need I add, that the wire gauze is to prevent the flame of the lamp from igniting the combustible mixture of gas and air arising from the balloon.* SEPTIMUS PIESSE.

241, Oxford Street.

* A reading lamp might be made upon the same principle, trimmed with oil.

POOLE'S PATENT IMPROVEMENTS IN THE MANUFACTURE OF CAUSTIC SODA AND CARBONATE OF SODA.

(*Abstract of Specification.*)

The nature of the invention of a new method of manufacturing caustic soda and carbonate of soda, consists in the following system or cyclus of operations, by which these products are gained from common salt; that is to say, I first prepare sulphate of soda, by the mutual decomposition of common salt, or chloride of sodium and sulphate of ammonia, by which decomposition, sulphate of soda and hydrochlorate of ammonia are produced. The sulphate of soda is then converted into sulphuret of sodium, by heating it with charcoal or any other carbonaceous substance, and this sulphuret of sodium is decomposed by the protoxide of copper, by which decomposition caustic soda is formed; which, if requisite, may be evaporated to solid caustic soda, or saturated with carbonic acid, and thus converted into carbonate of soda.

The sulphuret of copper afforded by the decomposition of sulphuret of sodium and protoxide of copper, is then calcinated in a current of atmospherical air, by which operation deutoxide of copper is formed; the sulphur being burned and volatilized in the state of sulphurous acid gas. I then combine this latter acid with caustic ammonia, gained by the decomposition of the hydrochlorate of ammonia, by means of lime, exposing hereafter the sulphate of ammonia thus gained to the action of atmospherical air, and regain sulphate of ammonia, which is then again used for decomposing common salt.

Lastly, the deutoxide of copper is converted into the state of protoxide by moderate heating, with a certain quantity of coal. The same cyclus of operations may then be recommended; the ammonia, as well as the protoxide of copper and the greater part of the sulphur, being recovered.

I shall now give a more detailed description of this process or processes, divided in the following seven parts:—

First part.—As the conversion of common salt into the state of sulphate of soda, by its mutual decomposition with sulphate of ammonia, is a well-known process, a description of it will be superfluous. The hydrochlorate of ammonia gained hereby, is used afterwards for restoring sulphate of ammonia, as will hereafter be described.

Second part.—The decomposition of sulphate of soda by means of heating it with coal, charcoal, turf coal, coke, or any other

sort of carbon, is likewise a well-known process; but I recommend to effect this decomposition in any closed vessel, in order to prevent the loss of a large quantity of sulphur, which would otherwise be burned and thus volatilized.

Third part.—The sulphuret of sodium gained by the latter operation, is then dissolved in water and filtrated, in order to separate the remainder of coal (which may be employed for subsequent operation), whereupon protoxide of copper, in the state of a fine powder, is added to the liquid slowly, and in little portions; and by well stirring the matter until the decomposition of the sulphuret of sodium will be just found to be completely effected, by adding to a small portion of it some drops of a solution of sulphate of copper, which, if the decomposition is not yet finished, will produce a precipitate of a blackish colour, but will give a precipitate of a pure blue colour, if the decomposition of the sulphuret of sodium is completely done. The sulphuret of copper is then separated from the liquid containing caustic soda, by filtrating, or in any other convenient manner.

Fourth part.—The solution of caustic soda may then be evaporated to dryness, in case of solid caustic soda being required. If carbonate of soda should be wanted, the solution of caustic soda is to be saturated with carbonic acid. Although any manner for causing caustic soda to get in contact with carbonic acid may be adopted, I prefer to make use of a large vessel or chamber, constructed of bricks and covered on the inside with Roman cement, or any other convenient substance, filled up with pieces of granite, limestone, or any other sort of stone, excepted only such sorts of stones which could be considerably attacked by the caustic liquid. I suffer the liquid to flow gently over the stones, and, at the same time, I introduce a current of carbonic acid gained by the combustion of coal, coke, charcoal, or any other convenient combustible, on the inferior end of the chamber. The carbonic acid passing through the interstices of the stones, will thus be absorbed by the caustic soda, carbonate of soda being formed, which hereafter may be evaporated and calcined in the usual way.

Fifth part.—The sulphuret of copper gained, as described in the third part of this specification, is now to be converted into deutoxide of copper, by calcining it in such a way as to allow the sulphurous acid gas produced by this calcination, to be received in the apparatus destined for the preparation of sulphate of ammonia. I effect this calcination in an iron muffle, heated to a feeble degree of glowing; and I cause a slow current of atmospherical air to pass through the muffle and then into the apparatus, which will be described in the sixth part of this specification. The sulphuret of copper, which may form a couch of about one inch in the muffle, is to be well stirred, until the smell of sulphurous acid is observed to have ceased. The deutoxide of copper is then taken out of the muffle, and a new portion of sulphuret is introduced in such a way, that the muffle may be kept in continual heat. It is now to be remarked, that the deutoxide of copper brought into contact with the protosulphuret of sodium, would decompose this latter so as to form a considerable quantity of hyposulphate of soda mixed with caustic soda. It is in order to prevent this hyposulphate of soda from being produced, that I employ the protoxide of copper, which is obtained by mixing the deutoxide of copper with about one-twenty-eigth of its weight of powdered charcoal or turf coal, and by heating this mixture in a well-closed vessel of iron or any other suitable material, to a feeble degree of glowing.

Sixth part.—I have already observed, that the sulphurous acid gas, by the calcination of sulphuret of copper, is to be received in any apparatus, in order to be saturated with ammonia. I get this ammonia by distilling the hydrochlorate of ammonia gained, as described in the first part of this specification, with caustic lime. In order now to combine this ammonia with the sulphurous acid, I employ a large vessel or chamber, constructed of lead or any other suitable material, filled with chipping of fir-wood. By means of a ventilating apparatus, I cause a moderate current of atmospherical air to pass over the glowing sulphuret of copper in the muffle, as is above described; and after being sufficiently cooled by passing through a pipe surrounded by cold water, to move slowly through the interstices of the chipping. At the same time, the caustic ammonia is also introduced on the upper end of the chamber, and gliding slowly over the chipping, it thereby absorbs the sulphurous acid, and is thus converted into the state of sulphate of ammonia. In order to prevent any loss of ammonia that could be caused by the current of the air leaving the chamber, I employ a second chamber; or if it should be found convenient, several chambers of the same construction as the first, and also filled with chipping, through which the current of air is forced to pass, and over the chipping

of which, a very feeble solution of sulphuric acid in water is caused to flow. By this means the ammonia, which could have been carried off by the air leaving the first chamber, is entirely absorbed, and thus saved; sulphate of ammonia being formed, which may be added to the solution of sulphate of ammonia, the preparation of which forms the last part of the process.

Seventh part.—This process, consisting in the oxydation of the sulphate of ammonia to ulphate, is very easily performed, by exposing a solution of the former salt to the contact of the atmospherical air. I employ for this purpose a frame or scaffold, constructed of timber, in any convenient manner, which I fill with chipping of fir-wood, in such a way as to expose this chipping as much as possible to the access of atmospherical air. The solution of sulphate of ammonia is then caused to flow gently over the chipping, and, being received in a flat chest placed below the chipping, is pumped up again, until it is observed to be entirely converted into sulphate of ammonia, which is hereafter used for decomposing common salt, as is hereafter described. The manner of trying the sulphate of ammonia, or its being perfectly formed, consists in the addition of some drops of sulphuric acid to a small portion of the liquid. If by this addition a smell of sulphurous acid should be observed, the oxydation is not yet entirely finished.

KEENE'S PATENT PROCESS FOR RENDERING LEATHER, &c., WATERPROOF.

(Abstract of Specification.)

The object of this invention is to obtain an outside surface of Indian-rubber to leather, in order to render the same waterproof, and also to offer an external surface to be worn in place of the ordinary dressed or obtained surfaces of leather, which are used for boots, shoes, and other articles, where it is desirable to have a waterproof external surface to leather. The ordinary means heretofore used in producing surfaces on leather, either when tanned or otherwise prepared, has been by dyeing, painting, or gilding it, and afterwards applying a varnish suitable for the purpose, prepared from albumen, resin, or gums which have not rendered them waterproof or impervious to damp; but there has been waterproof leather made, with a polished surface, by coating it with linseed oil and colouring matter, and afterwards working it up to a polish or gloss, by friction or japanning; or japan may have been used upon leather in its ordinary state; but these are liable to chip or crack, when curved or bent in or over an angle. Now the object of my invention is, to produce on leather a surface that shall be waterproof, or partly waterproof, according to the substance thereof, or thickness of the material applied thereto; having all the elasticity, and more pliancy than leather heretofore in use, which shall not be liable to chip or crack, and will be considerably strengthened by the application.

In order that my invention may be fully understood, I will now proceed to describe the method of preparing the materials, and also to explain the process of using the same:—I take 100 pounds of Indian-rubber, and cut it into small pieces, or bruise it into thin sheets between rollers, or by some other means, and saturate it in about 200 pounds of turpentine, or any of the known solvents for caoutchouc, for twenty-four hours, more or less; but that generally answers the purpose, for the caoutchouc has then absorbed the oil or solution, and is fully decomposed therewith. I then pass it through a pair of crushing rollers, set nearly close, which I continue several times; and, while this process is going on, I sift lamp-black or other colouring matter on to it, in sufficient quantity to give it the required hue; and when the whole is worked into one uniform mass to the consistency, or thereabouts, of stout dough or putty—that is to say, neither in a fluid or solid state, I keep it in this condition, in a reservoir of water, ready for use. I would here remark, that the skins or leather to which my invention is best applied, are in the form of what are called doe skin, buck skin, wash-leather, and the like. The skins being prepared in the ordinary manner, I select such as are of uniform thickness, and nearly equal in size; and having adjusted a pair of rollers to suit the thickness of the skins and quantity of pulp required to be laid thereon, the roller which faces the pulp being supplied with a damper of water, keeping it continually wetted thereby, while the process is going on, which prevents the pulp of Indian-rubber from adhering to the rollers, or being drawn from the skins; the other roller should be kept clean and dry, except when desired to put a surface on both sides, which may be put on at once, or one after the other. I prefer having both rollers to lay horizontally, or on an inclined plane, under an angle of 45°, being about eighteen inches in diameter. I commence by placing a skin over the dry

or front roller, in a smooth and even direction, the rollers being turned until they just take an edge of the skin between them; I then wet my hands, and take from the bulk of the pulp of Indian-rubber a sufficient quantity, or rather more than enough, to cover the skin; and I pull or work the Indian-rubber into a long roll, the width of the skin; I lay it close down in the hollow, between the leather and the wet roller. The rollers being then turned, the skin passes through them, receiving a smooth coat of the flexible and waterproof material upon its surface, being thoroughly pressed into the fibres and pores of the leather; and, when dry, it may then be embossed or gilt, in the usual manner of gilding or embossing leather, furnishing it with some material to give it a gloss, and remove the adhesive properties. For this purpose I use shell-lac, dissolved in spirits of wine, with a small quantity of Venice turpentine; or other materials may be used if required. I put two or more coats upon each other upon the surface, and, in some cases, after it is dry, I pass it through either smooth or embossed rollers, or I press it between embossing plates, or smooth ones.

LONDON AND BIRMINGHAM RAILWAY.

From the 17th September, 1838 (the date of the general opening of the line), to the 31st of August, 1840, the passengers conveyed amounted to 1,239,526; the aggregate of miles travelled, to 80,945,952—equal to sixty-five miles and three-tenths for each passenger.

No case of death or fractured limb has occurred to any one passenger. One passenger was severely hurt on the head, on the incline between the Euston and Camden stations; and one, on the back, at the Coventry station. In both instances the parties recovered.

No engine has run off the rails, except in two or three cases, when the points were set wrong at the crossings, which is now effectually guarded against by the present improved plan.

Every engine-driver has the sole care of the engine which he drives, and is required to examine it carefully and clean it thoroughly after each trip.

The number of *passenger* trains running daily, is twenty-eight.

One passenger engine broke an axle on the London side of Harrow, and another a few miles on the same side of Wolverton. A goods' engine, drawing nineteen loaded waggons, also broke an axle one mile from Watford; and all the three (being the only instances of broken axles) brought their respective trains in perfect safety to the Camden station.

The performance of the engines is as follows:—

Number of engines	82
Number of miles run since the opening of the railway......	1,635,396
Average number of miles by each engine....................	19,944
Greatest number by any one engine	41,932

LANCASTER AND PRESTON RAILWAY.

A special general meeting of the shareholders of this railway was recently held at the Town Hall, Lancaster, in pursuance of a requisition, signed by fifty-five shareholders, complaining of the defective accommodation provided for travelling on Sunday, and calling upon the directors to provide additional trains to meet the public wants and convenience. The meeting was not very numerously attended.

The usual arguments resorted to on such occasions were urged by each contending party; on the one hand it was recommended, that all passenger traffic should be suppressed on Sundays, and a feeling of "dread and horror" was expressed, lest any encroachment on the Sabbath should take place. On the other hand, it was contended, that the public had a right to decide, according to their own consciences, whether or not travelling *is* a profanation of the Sabbath. The friends of toleration prevailed; votes being taken for and against the motion, "that public convenience demanded farther accommodation on the Sunday, and that the meeting was of opinion, that one or more additional trains were required; such trains, however, not to run during the hours of Divine service."

The chairman declared the number to be as follows:—

For additional accommodation on Sunday, 117 shareholders having	2446 votes
Against 63 shareholders having	961

The motion for additional accommodation was thereupon declared to be carried.

When we consider the almost boundless toleration extending to every one of the innumerable religious sects in this country, we cannot help feeling much regret, that any of those who enjoy so great

a blessing, should entertain such harsh and unkindly feelings towards others who differ from them in opinion. A country excursion is in itself an innocent, rational, and salubrious recreation; and while those who think it wrong to go out on a Sunday, have full liberty to stay at home or attend a place of worship, without molestation, it amounts to absolute persecution to attempt to coerce others to adopt the same course. The two greatest enemies to religion, are *cant* and *persecution;* and they are the more loathsome and detestable, as they appear in the garb of religion itself.

CALCULATION OF INTEREST.

QUESTION.—What is the number in a table of interest, expressing the value of 1*l.* for 149 days at five per cent. per annum simple interest?

The following is the entire operation:—

```
    3
  ——— •
   .05 . . .
     9 . .
  ————————
 .0204109589, interest of 1l. for 149 days.
```

There is no mental calculation in the above operation, every figure is set down as it presents itself by an unerring law, to which the rate is subject. The tabular number of any other number of days, from 1 to 365, being found with equal ease, conciseness, and certainty.

"Querist" requires the investigator to discover the law by which the operation is performed. He also asks—Are all other rates per cent. per annum subject to the same law, or are there any of them? If all, show how they are so subject? If none, show why not? If any, distinguish which, or how many? And if there be any additional trouble, or any less? Say how these occurrences take place.

"Querist" puts this question likewise:—What is the least number of operations requisite to construct a table of interest for every number of days in the year (that is, 364 numbers), and how many lines suffice to express it?

The great utility of the rule which originates with this law is obvious. For example:—

Find the interest of 10,402*l.* 14*s.* 2*d.* for 149 days at five per cent. per annum?

```
    3
  ——— •
   .05 . . .
    . 9 . .
  ————————
 .0204109589, interest of 1l. for 149 days.
  807.20401    the multiplier (that is, the principal) inverted, and three decimal
  ————————      places retained, and then by the well-known contracted method of multiplication—
   204110
     8164
       41
       14
  ————————
 212,329 or 212l. 6s. 7d. the interest.
```

Should it be desirable to have the result in shillings, a corollary arises in course of investigation which develops the rule.*

MECHANICAL PROBLEM.

To the Editor of the Mechanic and Chemist.

SIR,—I trust that you, or some of your worthy correspondents, will answer the following question:—

Supposing that I have two shafts to sink, or, at least, that they are already sunk, the one to be 100 yards deep, the other 160, the same engine to wind out of both alternate, that is, one up and the other down; the diameter of the barrel that winds out of the 100 yard pit, is two feet six inches when all the coil is off; when the coil is on, it is eight feet in diameter; and the barrel of the 160 yard pit is to be placed on the same axis; what size barrel would be required (when the coil is off) to work them both up and down alternate? A full illustration of the above in the "Mechanic and Chemist," will greatly oblige a constant reader,

PHILOLOGUS.

[If the ropes were to wind round cylin-

* Gentlemen desirous of communicating with "Querist" on this subject, will please address, "P. Gaynor, at the School of Theoretical and Practical Science, 31, Sheffield Street, Dublin." All letters post paid.

ders of uniform diameter, their proportion would be as the depth of the lesser shaft to that of the greater; but as each revolution of the axis adds one coil of rope to each of the cylinders, their diameters must increase in arithmetical progression, and destroy the original proportion. Take therefore, the mean term of the given diameters (5.25 ft.), and say 100 : 160 : : 5.25 : mean term of greater cylinder, which gives 8.4 ft., and deduct 2.75 (half the coils of rope), 5.65 ft. will be the diameter required. Universally, if a be the diameter of lesser cylinder when the rope is off; b, ditto, when all the rope is on; C, depth of lesser shaft; D, depth of greater shaft; x, diameter of greater cylinder without the rope; and y, ditto, with all the rope on,

then $\overline{a + \frac{b-a}{2}} \times D = \overline{x + \frac{y-x}{2}} \times C.$

In this calculation it is assumed, that the diameters increase and decrease uniformly, as if a band of equal thickness throughout were wound upon itself, so as to form a compact spiral; but it will be found in practice, that considerable variations will occur, unless the ropes be so arranged as always to coil in the same order on the cylinders.—ED.]

MISCELLANEA.

A single train from Leeds to Sheffield, lately performed the journey with no less than 2400 passengers! The train consisted of seventy-three carriages, and was drawn by four engines.

Newton found, that a ball of glass, or a watch-glass laid upon a flat surface of glass, does not touch it, and cannot be made to do so by the force of even 1000 lbs. to the inch.

To Bleach Vegetable Wax.—Mr. E. Solly, in experimenting for the purpose of bleaching vegetable wax, found that the best effect was produced by chlorine, but that it is necessary that the materials used to evolve the gas, should be intimately mixed with wax; but when a stream of chlorine was slowly passed through the wax, the process became very tedious. He subsequently found that strong nitric acid was a powerful decolorating agent, and possessed the advantage of having no residue which is at all difficult of separature; but this process is expensive. Mr. E. Solly subsequently employed the following process:—The wax was melted; a small quantity of sulphuric acid was poured in, composed of one part of oil of vitriol to two of water, and then a few cyrstals of nitrate of soda stirred in; the whole was then agitated with a wooden stirrer and kept heated. Nitric acid was thus evolved in considerable quantity and purity from a large surface, and in such a manner that all the acid evolved must necessarily pass through the melted wax. This method answered the purpose very completely, the process was cheap and rapid, and the residuum, being merely a little solution of sulphate of soda, was easily removed. When it is desired to employ chlorine in the place of nitric acid as the bleaching agent, the same process may be adopted.

INSTITUTIONS.

LECTURES DURING THE WEEK.

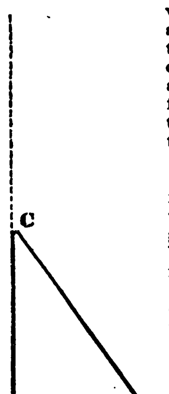
London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, November 4, R. H. Semple, Esq., on the Metals. Friday, November 6, W. H. Woolrych, Esq., on the Duties of an English Magistrate. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, Nov. 5, S. Preston, Esq., on Pneumatics. At half-past eight.

Franklin Mutual Instruction Society, Half-moon Alley, Lower Whitecross Street.—Tuesday, November 3, Rev. J. C. Means, on the History of France. At half-past eight o'clock.

Chemical and Philosophical Society, No. 241, High Street, Shoreditch.—Wednesday, November 4, H. Jones, on Botany. At half-past eight precisely.

QUERIES.



A pole, sixty-three feet long was broken by a blast of wind at a certain distance, C, from the ground; so that the top of the pole struck the ground at A, twenty-one feet distant from the base of the pole; the question is, how long is the standing piece?

A. M. A.

Are there any patents in force for the manufacture of vinegar; and if so, to whom granted, and when? The best method of manufacturing wine or beer from the sugar beet? Also, the cheapest system of heating by warm water a room on the ground floor, 20 feet by 10 feet, 12 feet high, so as to obtain 140 degrees of heat?

ROWLUND.

The mode of preparing a blue ink which does not decompose, and also a copper ink formula?

A. N. S.

A description of the simplest practical means of taking a cast of the head and face of a person (more particularly the forehead and face) for phrenological purposes? G. S. Jun.

The manner in which an electro-magnetic engine is constructed, where permanent magnets are used instead of the battery? G. M. W. H.

How medallion wafers are to be made, and how the impression may be removed off the seal, or whether it is requisite to prepare the seal with

some unctuous matter previous to using the composition? E. D.

The best method of making sky-rockets; also, how the stars are made that are placed on the top? E. C. B. H.

ANSWERS TO QUERIES.

Chemical Weather Glass.—I beg leave to inform "A. C. P." that the description of the *Chemical Weather Glass*, which I sent for insertion in the "Mechanic and Chemist," is abridged from Smith's "Panorama of Science."— Smith refers to Wight as his authority.

E. Ledger.

To preserve Animal and Vegetable Substances.—A correspondent asks "What is the best method of preserving Animal and Vegetable Substances." Various methods have been employed by different people, but the following extract from the report of Professor Henslow and Committee "on the Preservation of Animal and Vegetable Substances" read before the *British Association*, will, I think, afford him most information:—"The attention of the Committee was directed to the preserving properties of certain materials when applied separately, either in saturated solutions, or in different degrees of concentration. The experiments were conducted in jars six inches by one and a half; and saturated solutions of the substances employed having been prepared, were diluted with an equal and double quantity of water; 178 preparations of animal and vegetable substances were tried.

1. *Results obtained with Animal Substances.*—Three salts of potassa—the subcarbonate, the bicarbonate, and the arseniate, have afforded the most satisfactory results. The solution of the bicarbonate afforded a flocculent precipitate: the solution half saturated appeared the best adapted. The substances preserving next best are, sulphate of zinc, muriate of magnesia, sulphate of potassa, and alumina (common allum), muriate of ammonia, sulphate of potash. Corrosive sublimate is a perfect preservative of animal substances; but this salt renders the substances so very hard, that singly it is unsuited to the purposes of natural history; added in small proportions to other solutions, which render objects too soft, it will probably be found of essential service, as well also in preventing the formation of flocculent matter. One part of naphtha to seven of water produces a favourable result, but when used stronger, the specimens are rendered tough. Acetic and oxalic acids decomposed the skin and cellular membrane of fish, but left the muscles untouched. A few drops of kreosote added to water, preserve the objects, but they become stained dark brown. The following substances are entirely unfit for preservatives: carbonate of ammonia, chloride of potash, muriate of barytes, muriate of lime, nitrate of ammonia, nitrate of strontian, the nitrates of barytes, soda, ammonia, and magnesia, phosphate of soda, the sulphates of potash, iron, copper, and rough pyroligneous acid.

2. *Results obtained with Vegetable Substances.*—The success here is very slight. None of the salts seem favourable, with the exception, perhaps, of the sub-carbonate and bicarbonate of potash. In naphtha and acetic acid, the specimens are preserved, but in the latter they lose their colour, and assume a reddish tinge. Professor Henslow adds, that, although carbonate of soda of the shops is not mentioned in the report, he finds it to possess considerable preserving powers on animal substances. Fruits and other parts of vegetables may be preserved well in a solution of common salt and water. Arseniate of potassa also preserves the colour of flowers well." P. Truman.

TO CORRESPONDENTS.

W. Harlington.—*The figures placed on the right-hand-side of the point, are decimal fractions; all decimals may be converted into vulgar fractions by drawing a line, and placing under them as many 0's as there are figures in the decimal, and a 1 at the left of them:* 71.80, *means* 71 *and* $\frac{80}{100}$. *So, when there is but one decimal figure, it expresses the number of tenths; when there are two decimal figures, they express the number of hundredths, and so on to any number of figures. The decimal mode of calculation is more convenient, but, in many cases, less accurate than vulgar fractions.*

Specific gravity is the weight of a given bulk of any substance; the specific gravity of silver is to that of tin, as the weight of a cubic inch of silver is to the weight of a cubic inch of tin.

The height of mountains &c. is found by the barometer; the height is not usually estimated from the surrounding country, but from the level of the sea; that is, reckoned from a point which would correspond with the surface of the sea, were it allowed freely to flow there.

No compression will cause atmospheric air to explode, because it does not possess the necessary elements of combustion; but it will produce an evolution of heat, sufficient to ignite inflammable matter such as amadon or german tinder &c. this phenomenon is explained by the doctrine of latent heat.

London: Printed at "The City Press," 1, Long Lane, Aldersgate, by Doudney & Scrymgour (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. Berger, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

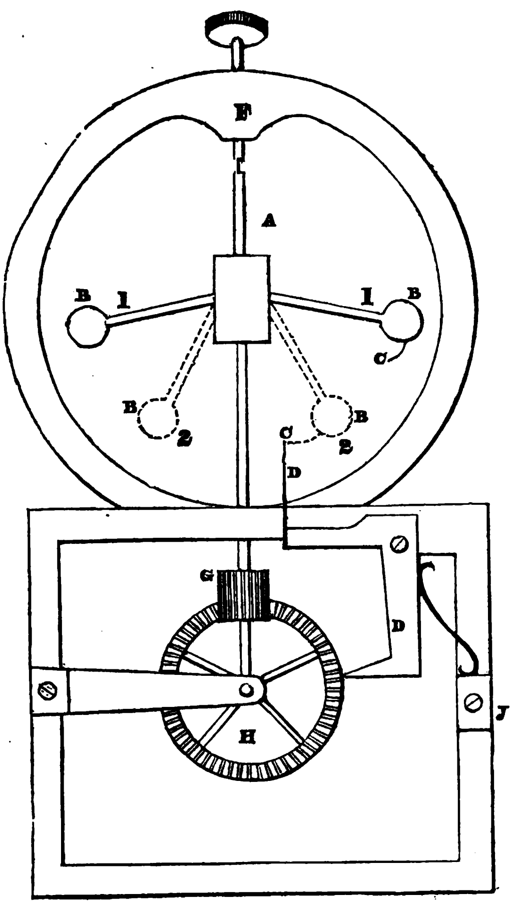
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 118, NEW SERIES. | SATURDAY, NOV. 7, 1840. PRICE ONE PENNY. | No. 239, OLD SERIES.

PATERSON'S CENTRIFUGAL ESCAPEMENT FOR CLOCKS.



City Press, 1, Long Lane: Doudney and Scrymgour.

CENTRIFUGAL ESCAPEMENT FOR CLOCKS.

(See engraving, front page.)

To the Editor of the Mechanic and Chemist.

SIR,—F F is a circular band or ring, having a cock attached at top for the pivot of the upright pinion, A, to act in an upright pinion, G, having sixteen leaves, which acts in contact with the contrite wheel, H, which has six teeth cut out, to allow the pinion, G, to revolve; B B, two balls attached to a lever, working in the frame of A, by means of two pivots. No. 1 shows the full extent of velocity of the two balls. No. 2, the balls as when their power is expended; C, a pin attached to one of the balls, which, when the velocity of the balls, No. 2, is expended, strikes the detent D, which causes the contrite wheel, H, to perform one revolution; T, a spring acting on the detent, D, to return it to its place.

I am, Sir, yours, &c.

J. PATERSON.

[We have omitted a portion of our correspondent's description, it being too obscure to be understood. The principle, which we believe to be entirely new, will, however, be easily seen by inspection of the engraving. This construction is objectionable, in being subject to considerable variation, when any alteration takes place in the power applied to the pinion, G; but as an ornamental escapement, where extreme accuracy is not required, it might be made a very beautiful object; and we recommend it to the attention of our horological friends.—ED.]

LOWE'S PATENT IMPROVED METHOD OF MANUFACTURING GAS.

(Abstract of Specification.)

THIS invention relates to a mode of combining and working retorts in the manufacture of gas from coal, and in such manner, that the products alternately of one of two retorts shall be caused to pass into, and mix with, the products of the other retort; by which means, whichever of the two retorts has been last charged, the products thereof during the early hours of working, shall pass into the retort, which, with its charge, is in a highly heated state, from its having been much longer at work; and the retorts are so connected, that, by means of a valve and apparatus external of the brick-work of the setting of the retorts, that, during the time of discharging and charging either of the retorts, the gas from the other retort shall not pass into the retort with which it is connected, and which is long discharged of its contents, or recharged with coal.

Two retorts are connected together at the back ends, by means of a pipe, having an ordinary slide valve, by which the communication between the two retorts can be shut during the time of charging or discharging either of those retorts; and they are not charged at the same time, but at an interval of three or four hours apart—that is, about half the time of working off a charge.

Another part of this invention relates to the combined using of clay retorts and iron retorts. In setting iron retorts, as is sometimes practised when working according to what is called the descending flue pan, the upper retorts of iron are usually shielded or protected with fire-bricks or tiles, when the furnace is so arranged as to cause the products of combustion to pass downwards, after having ascended and passed over the upper retort or retorts, as is very commonly practised; and such shielding or protecting the upper iron retorts is rendered necessary, owing to the great heat to which the upper retorts, under such circumstances, are subjected. In some cases, clay retorts have been used, but without combining therewith retorts of iron in the same furnace or oven; by which arrangement, although beneficial in respect to the upper retort or retorts, owing to the great heat to which they are liable, such arrangement is not beneficial for the lower retorts, which, being operated upon by a much lower degree of heat, the slow conducting properties of clay retorts do not, in such situations, offer that quick means of transmitting the heat to the interior of such retorts as is desirable.

Now the object of the second part of the invention is, to employ upper retorts made of clay, and the lower retorts made of iron.

By this arrangement it will be seen, that at those parts of the oven where the greatest heat will be found to exist, the retorts are made of clay; and at those parts where the temperature will be much less, and where it will be desirable to conduct the caloric as quickly as possible into the retorts, the better conductor, iron, is employed for such retorts.

Another part of this invention relates to a mode of applying heat to retorts during the early hours of decomposition. It is well known that, during the early periods of the working off of a charge, much of the products evolved are not converted into permanent gas, but are condensible

vapours, which arise from the circumstance of cooling down of the retorts by the fresh charges of coal: hence it is desirable to have a more excited combustion of the fuel employed during the early hours of distillation, than has heretofore been practised; and this part of the invention consists in applying a blast of air into the ash-pit of the furnace, the ash-pit being closed; as is well understood in constructing furnaces with closed ash-pits, for other purposes. And when the retorts have been fresh charged, a blast of air is to be forced into the closed ash-pit, in order to excite the fire in the furnace, that it may continually keep up the heat of the retorts, notwithstanding the quick rate at which the heat is taken up and carried off by the charges of the retorts, during the early part of the distillation; and such blast of air is continued for about two or three hours, and then open the ash-pit and permit the fire to burn by its ordinary draught.

Another part of the invention relates to a mode of heating retorts in the manufacture of gas; and it consists of an improved mode of employing gas-tar as a fuel. Breeze or small cinder is mixed with a quantity of coal-tar, to saturate it, which is charged into one of the retorts, and the distilled products conducted by a pipe from such retort to the fire of the furnace, which is heating that and other retorts in the same oven; by this means we are enabled beneficially to consume coal-tar. This part of the invention will be found particularly advantageous, when the number of retorts in an oven or ovens are too many for producing the quantity of gas required at a given time, which is often the case, and in place of letting the retorts lie idle; in such cases, the products from them, when charged with breeze and tar, would be turned into the fire, by having pipes applied to the mouth-pieces or other convenient parts of the retorts; and, when it is desired again to use such retorts for manufacturing gas for the purposes of illumination, the cocks or valves, which are placed on the additional pipes leading to the fire, are to be closed.

Another part of the invention relates to a mode of constructing and working retorts, which are set vertically, or nearly to, and so arranged as to be charged at she upper ends, and, from time to time, drawn at the lower ends; and wherein the fresh charges are constantly descending towards the lower ends; and the novelty of the invention consists in so constructing such retorts, as to cause the gas evolved from the fresh charges to descend, and pass amongst the highly-heated charges, and mix with the gas evolved therefrom; whereby a similar result will be obtained to that first described—the products of gas evolved from the fresh charges not being permitted to pass off by themselves, but are caused to mix with the products of gas evolved from charges which have been much longer under operation.

STONE'S PATENT RHUBARB WINE.

(Abstract of Specification.)

When the green stalks or stems of the rhubarb plant are arrived at their full size, which will generally be about the middle of the month of May, I pluck from the plant the stems or stalks; I then cut off the leaves and throw them away; I bruise the stalks or stems in a large mortar, or other convenient means, so as to reduce them to a pulp; I put the pulp into an open vat or tub, and to every five pounds' weight of the stalk or stem, I add one gallon of cold spring water. I let it infuse for three days; stirring it three or four times in a day: on the fourth day I press the pulp in the usual manner, and strain off the liquor, which I place in an open vat or tub, and to every gallon of the liquor I add three pounds of white loaf-sugar, stirring it until the sugar is quite dissolved; I then let it rest, and in four, five, or six days, the fermentation will begin to subside, and a crust or head will be formed, which is to be skimmed off, or the liquor drawn from it, just when the crust or head begins to crack or separate; I then put the wine into my cask, but do not then stop it down. If it should begin to ferment in the cask, I rack it into another cask; in about a fortnight I stop down the cask, and let it remain till the beginning of the month of March in the next year, when I rack it, and again stop down the cask; but if, from continued slight fermentation in any cask, the wine then should have lost any of its original sweetness, then I put into the racked wine a sufficient quantity of loaf-sugar to sweeten it, and stop down the cask, taking care in all cases that the cask should be full. In a month or six weeks it will be fit to bottle, and in the summer to drink; but the wine will be improved by remaining a year or more in the rack after it has been racked. I would remark, that the plant in the autumn (about the latter end of August) will produce a second crop, when I make another quantity of wine, by pursuing a like process.

KOBER'S PATENT IMPROVEMENTS IN FIXING COLOUR IN CLOTH.

(*Abstract of Specification.*)

In consequence of the great affinity of bichromate of potash to the wool, as well as to the colouring ingredients, a comparatively small quantity of bichromate of potash will fix the dye-wares; that is to say, one pound weight of bichromate of potash can be used, instead of from three to four pounds' weight of alum or copperas; besides which, the colour produced by the use of potash, is fast in alkali and air, and better resists the operation of scouring, and the milling process employed in the manufacturing of cloth; and less colouring ingredients are required to be used than by the ordinary mode, because the colour produced thereby being faster, no loss of colour will take place by scouring the cloth with soap; and the fibres of the wool, in the dyeing of which bichromate of potash is employed, will not be injured (as they hitherto have been) by the acids contained in alum or copperas, and, on the contrary, the cloth will be softer and easier to be scribbled and milled, and, consequently, the same quantity of wool will produce a greater and better quantity and quality of cloth than by the method usually employed. I find the use of bichromate of potash most successful in preparing the wool for the reception of the colouring ingredients, particularly by fixing logwood, fustic, and wold, while redwoods and madder are less advantageously acted upon. As the ordinary colouring ingredients are employed in my application of the bichromate of potash; and as every different shade and colour require a different proportion of ingredients, and as the dye-wares differ so much in quality, that sometimes a double quantity of them is required: it is impossible to state the different proportions in which the bichromate of potash should be used with them; the weight of bichromate of potash to be employed, varying according to the quantity of ingredients to be fastened to the wool; but I generally employ three pounds' weight of bichromate of potash for preparing 100 pounds' weight of scoured wool, and I sometimes add two pounds' weight of argol or tartar, and in the liquid thus produced, I boil the wool for one hour and a half; and on the next day I fill the colour up with as much of the colouring ingredients, as the desired shade may require.

My invention consists, secondly, in obtaining green colours perfectly fast in acids, alkali, and air, by dyeing the wool blue, and then manufacturing the cloth from the blue wool, so as to make it what is called partly finished cloth with a white or light coloured list and head-ends, and then adding the yellow wares or ingredients to the cloth instead of to the wool; by which means a perfectly fast green colour will be obtained, in appearance like to wool dyed green, but much faster.

The modes of dyeing yellow are too well known to require any explanation; every kind of yellow ware is applicable to my invention, but I prefer fustic for its fastness; and in thus dyeing the partly finished cloth yellow, and in order to fasten the colour, I use hydrochloric acid saturated with tin, to which I add as much water as will give the solution a specific gravity of 12.612 or 30 degrees Baume; and of this solution I use from six to seven pounds' weight, for every one hundred pounds' weight of cloth, besides the usual quantity of alum and argol. This solution could not be applied to wool in flexes, as it would be destructive to the use of soap, and consequently to the milling process.

My invention, thirdly, consists, in the use of soda and bran for dissolving the indigo in the vats for dyeing wool, whereby the indigo is better fixed to the wool, and at a less expense than is incurred by the use of wood, madder, and bran, which are usually employed for that purpose. I use soda in the proportions, and in the manner next hereinbefore described; that is to say, in a seven-feet vat I heat the water to 125 degrees Fahrenheit; I then throw into the vat 65 pounds' weight of bran, 35 pounds' weight of common soda, which has about 23 per cent. of carbonate of soda, and four pounds' weight of indigo; I then proceed in the same manner as is usual in wood vats, by adding the usual and requisite quantity of lime; I then work the vat, from 110 degrees to 118 degrees Fahrenheit, three or four times during the day, without stirring; in the evening I again heat the vat to a temperature of 125 degrees Fahrenheit, adding an additional quantity of about four pounds' weight of lime, six pounds' weight of bran, and five pounds' weight of soda, with such an additional quantity of indigo as I may require to answer. On the following day, and in the evening after this addition is made, I stir the vat as usual, at the above-named temperature of 125 degrees. If the vat has been working during the day, I add the above quantity of lime, bran, and soda, every evening, which is necessary to keep the vat in a proper state, even if no indigo is added. The vat being kept in such

working state, I from time to time add as much additional indigo in the evening as I may require to consume the following day. It is impossible to state the exact quantity of indigo to be added. Any quantity of indigo, from half-a-pound weight to 25 pounds' weight may be added, according to the shade of colour required to be produced, the following day. After proceeding in this way for about eight or ten weeks, I do not empty the liquor in the vat; but I withdraw, or take out the sediment, and, with the liquor in the old vat, I set a new vat, adding thirteen pounds' weight of bran, and ten pounds' weight of soda, with as much lime and indigo as I may require. As the use of lime is to check the fermentation produced by the bran, it is impossible to state the exact quantity of lime which may be required. I employ as much lime as will check the fermentation in the vat to such a degree, as will be sufficient to deprive the indigo of its oxygen without an immoderate fermentation, which is very prejudicial. The same observation and application is necessary in working what I call my soda-vat, as it is in the ordinary wood vats, except that I do not employ any wood or madder; but soda may be used in conjunction with wood, madder, or bran; but I prefer using the soda with the bran only. The vat in which I use the soda must be perfectly yellow; that is to say, the indigo must be perfectly deprived of the oxygen; as it is generally termed, the indigo must be "sprung," in which case the vat appears yellow. By the use of soda-ashes (which have forty-six per cent. of carbonate of soda) instead of common soda, half the quantity will produce the same effect. Pearlash may likewise be employed, if the price will admit of it, and fine sharps may be used instead of bran. I therefore claim, as my invention, first, the use of the bichromate of potash as a substitute for copperas, alum, and other mordants.

Secondly, the production of perfectly fast-green colours, by dyeing the wool in blue, and adding the yellow ingredients, after it has been manufactured into cloth.

Thirdly, the use and application to indigo of soda and bran, or soda-ashes and bran, either by themselves, or mixed with wood and madder; whereby the colour is fixed to the wool better and cheaper than by the use of wood and madder alone.

PROGRESS OF EDUCATION.

To the Editor of the Mechanic and Chemist.

Sir,—I am happy to state, that the desire for education and moral improvement, which has long been glimmering in the neighbourhood of Coalbrook Dale, has at last been fanned into a flame. A gentleman of the name of Droffnore, who is travelling through England, lectured at Ironbridge on the benefits of moral and intellectual improvement, and the advantages of mechanics' institutes. This lecture had a good effect in arousing our dormant energies; and several gentlemen came nobly forward and offered their assistance in starting and supporting a mechanics' institution at Ironbridge. On the following Wednesday, the 21st of October, a public meeting was held in the infant school-room, Ironbridge, to take this subject into consideration; the business was settled by forming a committee of thirty persons—one-half gentlemen and tradesmen, the other half working men—to adopt the best means for forming an institution; and eighty-eight names were enrolled as members. Never do I remember hearing of a mechanics' institute beginning under more auspicious circumstances; situated, as it is, in the centre of a populous neighbourhood, with the united talents of the celebrated (Coalport) porcelain manufactory on one hand, and the extensive iron works of the Coalbrook Dale and Madeley Wood Companies on the other. The workmen already appear to appreciate its value; for, during the course of three or four days, the names have increased to 160. I trust we shall shortly be firmly established, and that the same favourable omens which have marked our commencement, will continue with us through our career; may hundreds reap the benefit that will be conferred upon us by this institution, and may its beneficial influences be extended to a rising generation, who will then greet with pleasure each succeeding anniversary, and gratefully look at the names in their records, of those gentlemen who first stepped nobly forward, and planted an institution at Ironbridge.

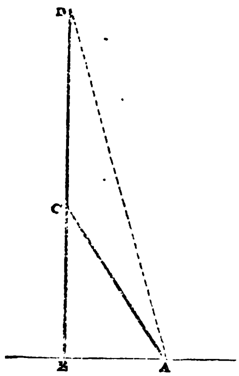
I remain thine respectfully,
John Child.

Coalbrook Dale, Salop,
Oct. 28th, 1840.

[We are much gratified to learn that the laudable exertions of our worthy correspondent and his friends, have led to so successful a result; and we trust that so

good an example will be followed in many other places, and ultimately produce the greatest benefit to the working classes. We shall always be happy to promote, to the utmost of our power, the success of such excellent institutions.—ED.]

GEOMETRICAL PROBLEM.



A POLE, sixty-three feet long, was broken by a blast of wind at a certain distance, C, from the ground, so that the top of the pole struck the ground at A, twenty-three feet from the base, B; how long is the standing piece, B C?

ANSWER.

	Logarithm.
As A B, 21 + B D, 63 = 84	1.92428
: B D, 63 — A B, 21 = 42	1.62325
:: Cotangent ½ ∠ B = 45°	10.00000
: Tangent ½ (∠ B D A ∽ ∠ B A D)	9.69897

Tangent 9.69897 = ∠ 26° 34′; consequently,

∠ B D A = 18° 26′

∠ B A D = 71° 26′

But ∠ C A D = ∠ C D A; therefore,

∠ C A B = 53° 8′, and ∠ A C B = 36° 52′.

	Logarithm.
As sine ∠ A C B, 36° 52′	9.77812
: A B, 21	1.32222
:: sine ∠ C A B 53°0′....................	9.90311
: B C, 28 feet	1.44721

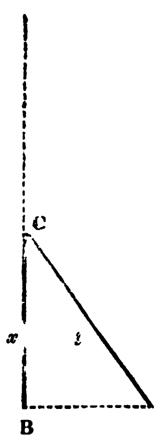
Therefore B C = 28 feet, and C A = 35 feet.

PROOF.

Square of C A, 35	1225
Minus square of B C, 28	784
Leaves..........................	441

Square of 21 is 441.

BY ALGEBRA.



Let the part C B = x, the length sought, and C A = y;

Then $63 - y = x$;

$y^2 - 441 = x^2$;

$3969 - 126y + y^2 = x^2$

$3969 - 126y^2 = y^2 - 441$;

$4410 = 126y$;

$35 = y$; consequently, $x = 28$.

G. S., Jur.

MISCELLANEA.

Electrical Clock.—A German artist, now in London, is about to take out a patent for the invention of a clock, worked by electricity. The machine, which is remarkable chiefly for its extreme simplicity, is composed only of a pendulum, one large wheel, two escapements, and a quadrature. Such are the visible parts. We must suppose, however, that a pinion and a wheel form the communication between this great wheel and the quadrature, though these are not to be seen. The pendulum, at each vibration, causes one of the escapements to advance the

great wheel one tooth; which, after this movement, has a pause, making the dead second. As there is no metallic moving power to set the machine agoing, we find, on examining, what keeps up the motion; that the pendulum (which is almost out of proportion with the clock) descends into a case, and there, at each vibration, the ball or body, which is furnished with a conductor, approaches alternately two poles, to which voltaic piles supply their portion of electricity. So that the pendulum, when once put in motion, retains it by means of the electricity alternately drawn from the two poles. There can be no doubt that other interesting results may be obtained, by employing the electrical fluid as a motive power, however slight the power which such an agent may seem capable of communicating.

Locomotive.—Mr. E. Rudge, of Tewkesbury, tanner, has obtained a patent for a new method or methods of obtaining motive power for locomotive and other purposes, and of applying the same. These improvements are for the construction and application of a new form of atmospheric engine, which may consist of two, three, or more open-topped cylinders, placed either vertically or horizontally, the piston rods of which are connected with two or three throw-cranks. The air below each piston in the cylinder is condensed by a jet of steam, when the preponderating influence of the atmosphere on the external surface of the several pistons produces the available power. The cylinders are lubricated by means of a small funnel on the top of the piston rod, whence the oil flows into a hollow space within the rod, and thence into a groove turned in the piston. In order to gain a reserve of power for any particular purpose, a large cylindrical receiver is filled by a condensing air-pump placed on either side, and connected with the main shaft of the engine; thus, when the carriage is descending a hill, the air-pumps will compress the air into the large cylinders, which again will supply the air for working the pistons while ascending a hill.—*Gloucestershire Chronicle.*

Railways in the United States.—In Pennsylvania, the number of railroads is thirty-six, the number of miles opened 576½, the total length of road 850½, and the amount already expended, 15,640,450 dols. In Virginia, the Carolinas, Georgia, and Florida, there are twenty-three roads, and 994 miles opened; total length, 1675¼ miles; amount expended, 18,442,000 dols. In Albama, Louisiana, Mississippi, Tennessee, and Kentucky, there are twenty-seven roads, 195 miles in operation; total length of roads, 1148¼ miles; already expended, 9,621,000 dols. In Ohio, Indiana, Michigan; and Illinois, there are twenty-nine roads, 196 miles in operation; total length of roads, 2821 miles; amount expended, 5,523,640 dols.

The archway of Ann's Hill, Brockhurst, intended for the Gosport branch of the South Western (or Southampton) Railway, fell in yesterday week with a great crash. The reason assigned for this is, that the brickwork is put together with cement, instead of lime, which dries on the instant, and does not give to the pressure; the consequence is, that if it does not at first adhere, the work will fall on any heavy weight going over it. —*Hampshire Herald.*

To Prevent Accidents on Railways.—The late lamentable accident on the South Western Railway, has, as is usual in such cases, given rise to various suggestions, with a view to prevent the recurrence of similar calamities. One of these is thus described by a correspondent of the *Times:* —"Until some effectual mechanical contrivance is invented to prevent or to diminish the effect of the collisions of trains, two persons should be appointed as 'look-outs' to each train; one to sit near to the engineer with his face directed forwards, the other to have a seat affixed to the last carriage, and his attention constantly occupied on the line over which they have passed; in fact, to turn his back upon the journey he is pursuing. Let the first man be provided with 'blue-lights,' something like what are called 'Roman candles,' of sufficient magnitude and brilliancy to be seen at a considerable distance, and let him be instructed to discharge these at short intervals; the 'look-out' behind would then see when a train was approaching (practice would soon teach him to calculate the speed), and give the alarm to his conductor, and the 'forward look-out' of the approaching train would also exercise similar vigilance, and be able to give the engineer instructions to slacken his speed at a sufficient distance, if not to prevent, yet most materially to diminish, the effect of a collision. The expense and danger (?) of this may be objected to, but in this age of invention, I have no doubt of a cheap, harmless, and efficient alarm being produced. The appreaching long nights especially demand that immediate measures be taken for the protection of passengers by railway. I would not, however, be understood as confining this precaution to darkness; for daylight requires it also, and, if necessary, the colour of the projectile might be changed."

A schoolboy, carrying about him a pocketful of marbles, carries enclosed in these playthings, air sufficient in quantity, and sufficiently noxious in quality, to prevent him, if he received it into his lungs, from ever playing at marbles any more. Again, from a very small quantity of red-lead, so much air of another kind may be extracted, as, if the boy were to breathe it, when almost dead from the effects of his marble dose, would rekindle the expiring embers of life and give him the power and disposition to roll his mortal and innocent bullet about again.

The fen districts in the Bedford level alone, amount to nearly 800,000 acres. This tract of fenny land extends over a portion of Norfolk, Suffolk, Cambridge, Huntingdon, Northampton, and Lincoln. It derives its name from the Earl of Bedford, who succeeded in draining it in 1649, after many previous unsuccessful attempts. The whole of the fen and marsh lands in England is, perhaps, not less than 800,000 acres.

It appears from the bills of mortality, that, in the latter part of the last century, the deaths from small-pox in the metropolis, averaged 2000 annually, or about one-tenth of the total mortality. In the year 1796, it prevailed with such severity, that, in the metropolis alone, 3549 lives are re-

corded to have been sacrificed to its virulence. The deaths by small-pox throughout England before the year 1800, were computed to be 45,000 annually.—*Lond. Sat. Journal.*

Horses will not touch cruciferous plants, but will feed on red grasses, amidst abundance of which, goats have been known to starve; and these latter, again, will eat and grow fat on the water-hemlock, which is a rank poison to other cattle. In like manner pigs will feed on henbane, while they are destroyed by common pepper; and the horse, which avoids the bland turnip, will grow fat on rhubarb.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, November 11, R. D. Grainger, Esq., on the Nutritive Processes in Animals. Friday, November 13, R. D. Grainger, Esq., in continuation. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street. — Thursday, Nov. 12, Capt. Saumarez, R.N., on the Origin and Progress of the Art of Restoring Suspended Animation. At half-past eight.

Franklin Mutual Instruction Society, Halfmoon Alley, Lower Whitecross Street.—Monday, November 9, T. C. Bowkett, Esq., on the Philosophy of Health. At half-past eight o'clock.

Chemical and Philosophical Society, No. 241, High Street, Shoreditch.—Wednesday, November 11, Mr. R. S. Jeffs, on Hydrogen. At half-past eight precisely.

QUERIES.

How to remove spots from polished steel, without injuring the polish? T. E. B.

How to render plaster casts impervious to the weather, without altering their colour? How to put a polish on them when not exposed in the air; or any information as to their preservation? I think I remember hearing of a receipt which was either a preparation of wax or soap.
A. H. Hedingham.

What is the best liquid for cleaning brass window-frames? W. B.

How to make the bleach used in manufacturing white calf boot-tops, or what will answer as well? W. Cloud.

The method of bleaching animal fat? It would be of great service to the trading community, if you would give such information in one of your earliest publications. That such process is in use, I am well aware, at the large manufactory of Messrs. Hawes, Commercial Road, Lambeth.
C. C. J.

What is the size of the largest crab-engines made, and its proportions, with a drawing, if convenient? J. Marriott & Co.

I am a brewer on a small scale, and have not room to fix a cooler; can any of your readers inform me, through the medium of your columns, of anything to keep water cold, so that a pipe passing through a butt may answer the purpose of a cooler? A. B.
Blackburn.

ANSWERS TO QUERIES.

In answer to your correspondent "N. M.", I beg to say, that the quickest and easiest method of killing oak, ash, &c., so that the trees shall remain standing, is by causing them to undergo the process called ringing, which is thus performed:—Take a bill-hook or small hatchet, and chop away a portion of the bark all around the stem of the tree, until the wood is laid bare; this breaks the communication of the sap from the root to the different parts of the tree, and in a short time destroys it. This operation is much practised in America, for clearing away the large forests which there abound.
D. Davison.

TO CORRESPONDENTS.

An Amateur Mechanic's *suggestion deserves serious consideration; it will not be lost sight of.*

Green paint, &c., is only an imitation of bronzing. The proper bronzing liquid is chiefly composed of linseed oil and turpentine, combined with the required colouring matter, and hardened by exposure to considerable heat, as in the process of japanning.

S. Whitelaw.—*Electrotype impressions may be produced in various kinds of metal; but not in the substances he mentions.*

Hope.—*The 5 at the eleventh place of decimals is a typographical error, and must be expunged. His other query shall be attended to.*

J. B.—*We are not in possession of the information he requires, but will endeavour to obtain it.*

London: Printed at "The City Press," 1, Long Lane, Aldersgate, by Doudney & Scrymgour (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. Berger, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 119, NEW SERIES. | SATURDAY, NOV. 14, 1840. PRICE ONE PENNY. | No. 240, OLD SERIES.

HADDEN'S PATENT PROPELLER.

Fig. 1.

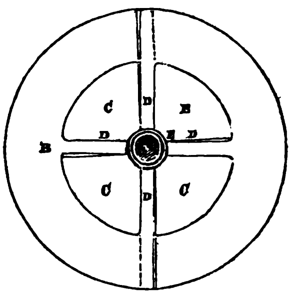
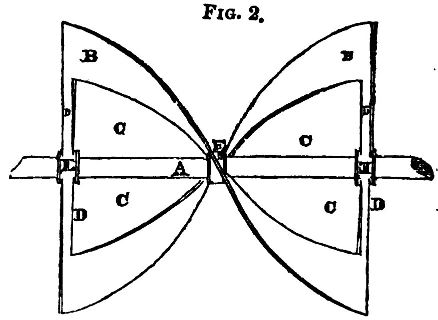
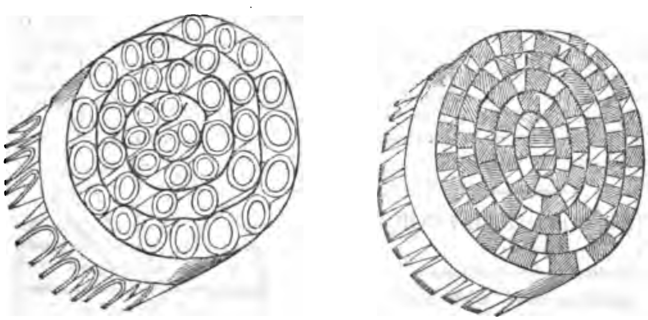


Fig. 2.

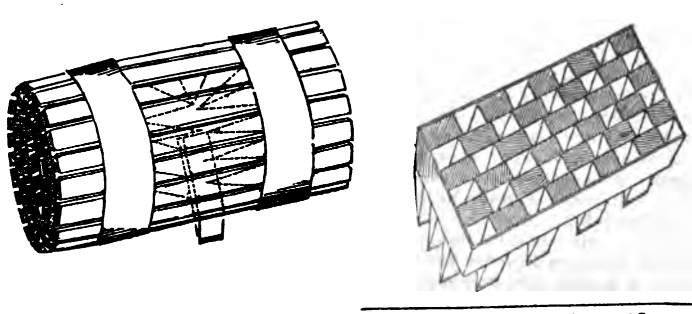


EDWARDS'S PATENT FOR PREPARING AND COMBINING MATERIALS USED FOR LIGHTING FIRES.

Figs. 1.



Figs. 2.



City Press, 1, Long Lane: Doudney and Scrymgour.

HADDEN'S PATENT PROPELLER.

(See Engraving, front page.)

(Abstract of Specification.)

My improvements are applicable to that description of machinery for propelling vessels, which is known as the screw, and consist in the formation of certain openings or spaces, in the central portions of the thread or threads of such screw, whereby the velocity of the impinging or propelling surface is rendered more equal, and a passage afforded for the water through the centre. In figs. 1 and 2, the same letters indicate the same parts.

Description of Engravings.

Fig. 1 is an end view; and

Fig. 2 is either a plan or side elevation of a screw, with two threads; or, technically, a double-threaded screw. A is a wrought-iron spindle or shaft, to which a rotary motion is to be given by steam or other power, by any known and convenient means; B B, two threads of wrought iron (which are drawn at an angle of 30°), with the spaces or openings, C C C C, cut away, so as to leave the supports or arms, D D D D, and which are keyed to the spindle, A, by means of the bosses, E E E.

I wish it particularly to be understood, that I do not limit myself to the use of a screw with two threads, or to the use of one screw only to each vessel, or to the exact dimensions of openings or spaces in such threads, or to the number of parts left for support; as I have merely described that which I deem best calculated to answer the purpose intended.

RENNIE'S CONOIDAL PROPELLERS.

(Abstract of Specification.)

Common paddle-wheels, with their rectangular floats have, on account of the great depth and bulk necessary to be given to them, in order that they may take a sufficient hold of the water, and of the position necessarily assigned to them at the sides of any vessel to which they are applied, a great tendency to increase the rolling of the vessel in heavy seas; present a most inconvenient breadth of surface to opposing winds, and, when they happen to be deeply immersed, offer a degree of resistance which the engines have difficulty in overcoming. And also the common paddle-wheels cause, by the striking of the edges of the rectangular floats upon the water, a strong vibratory motion in the vessel and machinery, and, consequently, a great increase in the wear and tear of both. Now the nature of my invented improvements consists,

Firstly, in applying to the common paddle-wheel a float of a new construction, by which the several defects before mentioned are either obviated, or their retarding influence greatly diminished; and,

Secondly, in substituting for the common paddle-wheel a new propeller of an entirely different construction, which revolves in the water without concussion, and may be fixed at the stem, at the stern, or at the middle, as well as at the sides of a vessel; and may be driven equally well, whether submerged to no greater extent than to be merely covered by the water, or to any greater depth.

Description of Engravings.

Fig. 1 is a lateral section of one radius of a paddle-wheel, fitted with the floats of my new construction; and

Fig. 1.

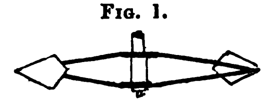
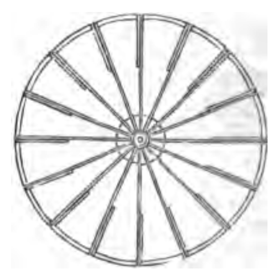


Fig. 2, a side view of the entire wheel. The floats are of a trapezoidal, instead of a rectangular form. I prefer that they should have the form of a trapezium, such as is represented in fig. 1, in which the diagonals are in the proportion to one another of one to one and a half, and that

Fig. 2.



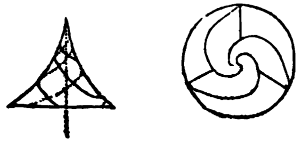
they should be so fixed, that the greatest of these diagonals shall be vertical, as is also shown in the said figure; but they may be of any other form which can result from the bisection of a cone; and whether the faces of the same be plain or convex, or concave, not only is the propelling power to be obtained by floats of this trapezoidal form, greater than what can be obtained from an equal amount of surface

of a rectangular shape, but they enter and leave the water more gradually and smoothly.

Fig. 3 is a side view; and

Fig. 4, a transverse section of the new propeller, by which I propose to do away with common paddle-wheels altogether. It consists of two or more curvilineal leaves or pliers formed as follows, and attached to a shaft or axis:—The curves of which the leaves or pliers should be

FIG. 3. FIG. 4.



formed, are obtained by the descent of a tracer down the surface of a cone or conoid, caused to revolve on its axis. Curves so obtained, have a constantly varying inclination with their axes; and I find, by experiment, that a shaft, with leaves or pliers formed after such curves, revolve in water with a greater propelling power than a shaft with any other sort of curved leaves or curved surfaces. The conoidal mould on which the lines are so traced, may be of any degree of inclination, from the apex to the base; but I prefer that it shall be of such a form, that its obscisses shall increase or diminish in arithmetical progression, while its ordinates increase or diminish in geometrical progression. The screw was employed of old, by Archimedes, to raise water, and it has, in more recent times, been also employed as a means of propelling vessels; but the screw differs altogether from a shaft, having attached to it leaves or pliers of the peculiar curvilineal form, which I have first described, inasmuch as the lines of the screw are obtained by the circumvolution of a tracer round a cylinder, while the lines of my propeller are obtained by the descent of a tracer down the surface of a cone or conoid, caused to revolve on its axis; and in this also, that the re-active force of the curves in the former case is far greater, and, consequently, the propelling power much less than in the latter. To distinguish my propeller from the Archimedian screw-propeller, as well as from all others, and by a name which shall at once indicate the distinctive and peculiar property from which it derives its superior efficiency, I call it the "Conoidal Propeller."

EDWARDS'S PATENT FOR IMPROVEMENTS IN PREPARING AND COMBINING MATERIALS USED IN LIGHTING FIRES.

(See Engraving, front page.)

(Abstract of Specification.)

MY invention relates to a mode of preparing and combining wood or reeds, or wood and reeds with other materials, into suitable bundles for lighting fires, which I call "ventilated faggots;" and, in order to give the best information in my power, I will describe the mode pursued by me in carrying out my invention. In forming bundles of wood, usually called fire-wood, as at present practised, it is customary to tie up several pieces of wood or sticks, or reeds, which, when used, are generally cut or untied to separate the pieces; and should such bundles be used without untying, the pieces of wood, sticks, or reeds, are too closely laid and retained together side by side, to offer a ready means of combustion to each and every part or piece at the same moment; in addition to which, the pieces of wood, sticks, or reeds, being of nearly equal size at each end, they do not offer a ready means of taking light.

Description of the Engraving.

Now, according to my invention, I so combine the parts or pieces of wood, sticks, or reeds, that there is a space between each of the neighbouring pieces, and thus allowing spaces, which may be called flues, and, by this means, introducing drafts or currents of air to rush through, and thereby aid combustion; and, in order to facilitate the first taking fire of each particular piece of wood, stick, or reed, I point or cut away the surface or surfaces, at one end of each piece of which the bundle is to be composed, and, in some cases, where the "ventilated faggots" are desired to light very quickly, I dip the pointed ends into melted brimstone, resin, or other inflammable matter. In combining the portions of wood, sticks, or reeds together, I employ resin, glue, pitch, or other adhesive material, preferring a material which is combustible, and by means thereof, I cause the pieces of wood, sticks, or reeds, to adhere to a strip of paper, rag, wood shaving, or thin wood, string, tape, or other cheap combustible material; each piece of wood, stick, or reed, being caused to adhere at a distance from the other, thus leaving spaces, which, when the whole is combined into a bundle, will offer what I have called small flues for drafts of air to pass through; and I cause all the pointed or sloped ends of the pieces of wood, sticks, or reeds, to be in one di-

rection, and which ends, when made into a bundle, form the lower part or end of the faggot. When I wish to make a cylindrical bundle or faggot, I fold the strip of rag or other material, having wood, sticks, or reeds therein, as above explained, in spiral layers, one around the other, as is represented at fig. 1; or the faggot may be oblong or square, as shown at fig. 2. And I would here remark, that my invention does not depend on the shape or figure of the bundle or faggot, but on the mode of so combining the parts of which each bundle or faggot is composed, that there are spaces between the different parts to produce or permit drafts of air through when lighted, aided by strips of paper, rags, shavings, or other thin combustible matter, which, with the inflammable adhesive matters and the pointed ends, in addition to keeping the parts separated, aid in the general combustion of the faggot. By such means of preparing and combining materials, I am enabled to light fires with more certainty, and, at the same time, with a great saving of fire-wood, sticks, or reeds; as the whole bundle or faggot, when made according to my invention, becomes quickly lighted throughout all its many surfaces, and thus produces a strong fire, which will quickly light the coal or cinder which is placed about the faggot. In using what I have called "ventilated faggots" in lighting a fire, a faggot is placed in the fire-place in its combined state, with the pointed ends of the pieces of wood, &c., downwards; then cinders or coals are to be packed around and above it, and a light is to be applied to the faggot at its lower end, when the whole faggot, or each and every part thereof, will become almost instantly inflamed. I would state, that in some cases I place several knobs of coal or cinder in the faggot, which, being in the direct drafts of the flames in the interior of the faggot, will be quickly in a flame, or red hot, and thus insure the lighting of the fire.

A VISIT TO A POT MANUFACTORY.

No. II.

After the clay has laid in the slip-house a few days, it is removed into a damp place, called the wedging-house, from whence it is fetched by those who work in the clay; that is, pressers and dish-makers, &c.

Previous to its being used, the clay is wedged. This operation is performed in the following manner:—A large piece (say seventy or eighty pounds) is placed upon a bench; the mass is then cut through with a wire, the ends of which the person who is wedging holds in his hands; then, taking up the piece with both hands, which he has thus separated, he throws it down again on the other parts with as great a force as he is able. This operation is continued until the whole lump is perfectly smooth cut at in any direction. This wedging of the clay is an operation of great importance, in order to expel every air-bubble—the beating in the slip-house not being quite sufficient for that purpose; and were the air-bubbles not thoroughly expelled, the ware would be spoiled, because the air, which is contained in the articles, becoming rarified and expanding while in the oven, would force itself out, and, blistering, spoil or very much injure the pots.

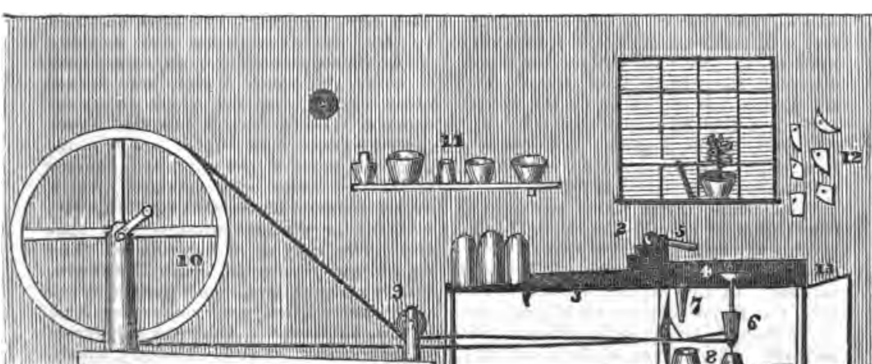
A piece of clay being wedged, it is brought to the thrower—a person who makes circular pieces of ware, such as cups, bowls, basins, mugs, &c. The machine on which these are made, is called the thrower's wheel. A representation of this machine is given in the annexed engraving.

The clay which has been brought to the thrower in large pieces, is first cut into smaller ones by a woman, called the taker-off, formed into small balls, and weighed. In the manufacture of coarse sorts of pots, the balls are not weighed; but for finer sorts they should be weighed, in order that all the articles of one sort may be of a uniform thickness. The thrower takes one of these balls and throws it on the circular board called the block (see engraving). The ball must be placed in the centre; if it is not, the action of the centrifugal force will soon drive it off the block. The machine moves gently while the ball is being placed on the block; it is now moved with considerable velocity, and the thrower, dipping his hands frequently in water, that the clay may not stick to them, fashions the ball of clay first into a long thin column, which he forces again down into a lump; these operations are repeated several times. When the vessel to be formed is of a large size (for cups and other vessels of a small kind), these operations need not be performed above once. They are done for a similar purpose as that of heating and wedging—viz, to expel the bubbles of air. This is of such importance in the manufacture of pots, that every means are taken to render the articles as firm and solid as possible.

The thrower now directs that the speed of the wheel be moderated, and proceeds to shape the vessel. This he does first, by his fingers, after which the inside is smoothed and wrought to its proper shape, and all inequalities, called *slurry*, are removed by instruments made of slate, called ribs. In making several dozens of the same sort of pots, it is requisite that they should all be of the same size. In order to preserve this uniformity of size, pigs, made of wood or iron, are placed as a guage on the edge of the box, in which the circular board revolves, in such a manner that, when the clay is brought to coincide with the guage, the thrower knows that the cup, or whatever it is, has attained its proper size. In this way the thrower forms his different sorts of articles; but it must be observed, that all circular pieces of ware are not made by the thrower. Saucers, plates, &c., are made by pressure—a branch of the pottery art we shall notice shortly. When the thrower has finished the article he is making to his satisfaction, he passes a wire through the bottom part of it, and the taker-off removes it and places it upon a board. When a sufficient number have been placed upon the board, it is removed by a person called the *looker-to-the-ware*, and another board being substituted, the thrower proceeds to fill that.

Considering the numerous operations performed by the thrower in making a single piece of ware, it is surprising how quick the articles are made by an expert workman. Some throwers will make as many as 160 dozens of cups (reckoning thirty-six to the dozen) in one day, which is about thirteen dozens in an hour, or rather more than seven per minute, reckoning twelve hours as a day.

The looker-to-the-ware takes the pots, which the thrower has made, into a large room, where a good fire is kept; or, if it be a fine sunny day, he puts them out of doors on the manufactory to dry, or to get hard, as the workmen call it. The pots, during this process of drying or hardening, require a great deal of attention; for if the articles become too hard, or get harder on one side than the other, they are likely to be broke when they come to be turned. When several boardfuls of ware have become sufficiently hard or dry, the articles are placed one upon the other, and carried into a damp cellar, where they remain until they are wanted by the turner—the person whose operations we shall notice in our next.



Description of the Engraving.

1. Large pieces of clay.
2. Balls formed by the taker-off, and placed there ready for the thrower.
3. Taker-off's bench.
4. The circular board or block.
5. The guage.
6. The spindle, upon the end of which the block is screwed; the lower part of the spindle runs in a step.
7. A spout for conveying away the slurry-water mixed with clay.
8. Vessel for holding the slurry.
9. A pulley for guiding the rope.
10. The wheel.
11. Articles of pottery formed by the thrower.
12. Profiles or nibs.
13. Seat for the thrower.

SPONTANEOUS COMBUSTION.

The occurrence of spontaneous combustion is much more frequent than is generally supposed. It is not confined to the action of chemical ingredients, artificially concentrated, but often takes place in substances apparently the most innocent and inert. A few years ago, much anxiety and suspicion were created amongst the inhabitants of the mountains on the eastern frontiers of France, by the frequent occurrence of conflagrations in the open country, destroying large tracks of the vegetation, which at that time was remarkably dry and parched by the sun. The first fire was attributed to accident; but, after frequent repetitions, it was generally supposed to be the work of malicious incendiaries. A different cause was, however, sought by scientific men; and the result of their researches was, that the whole mischief had been caused by spontaneous combustion. They did not obtain a complete and exact rationale of the process, but the observations and experiments they made, were conclusive enough to remove every doubt of the truth of their assertion. The very praiseworthy exertions of the Corporation of London for the preservation of life and property from destruction by fire, have elicited many valuable suggestions from scientific men; and we trust that every friend to humanity, who possesses any useful information upon the subject, will, without hesitation, communicate it to the Lord Mayor, or to the Committee appointed for the investigation of this important subject. Mr. Abraham Booth, Lecturer in Chemistry, in a letter to the Lord Mayor, remarks on spontaneous combustion as follows:—

"The cases under which spontaneous combustion of animal and vegetable substances will take place, are such as no ordinary sagacity can foresee, nor prudence prevent. In the official reported list of fires, the majority of causes is unknown, while another large portion are only conjectural. The science of chemistry may, however, advantageously lend its aid, and some of its investigations on the subject have been matters of high interest. The most memorable instance on record is that of a series of fires which took place at St. Petersburgh in 1780 and 1781, when a frigate, with several other vessels and houses, were destroyed, supposed to have been the work of an incendiary. A Scientific Commission was appointed by the Russian Government to inquire into the subject, who found that the self-enkindling substances were charcoal and hemp oil. In 1757 the Royal Dockyard at Brest, was nearly destroyed by spontaneous combustion taking place in the rope-yard, and some of the old workmen declared that the same thing had happened some years ago, but that, conceiving it impossible for the bales to take fire of themselves, they had concealed the accident, for fear of being taxed with negligence, and punished accordingly. On Thursday, July 3, 1760, a fire from spontaneous combustion broke out in the rope-yard of the Royal Dockyard at Portsmouth, which caused much mischief. It would be tedious to relate the other various circumstances under which spontaneous combustion will take place, such as with hay, corn, flax, cotton, wool, turf, flour, saffron, and other vegetable substances; rags, oatmeal, charcoal; woollen cloth and cotton goods; roasted coffee and chocolate; roots; bales of woollen yarn or cloth; waste cotton or rags used in cleaning oil, paint, floor-cloth, pyritous coal, &c., &c., although the subject is one of considerable importance in our domestic security."

THE CHEMIST.

NEW COMPOUND OF ARSENIOUS AND SULPHURIC ACIDS.

This new compound has been obtained by Dr. Shafhaeutl from the escaping smoke of copper-calcining furnaces, near Swansea, in South Wales, and is another singular instance where an anhydrous crystallized body is deposited under the presence of water only; and is a remarkable proof of the unlimited number of different forms of combination, which might be produced, even in organic nature, by bringing chemical substances in contact under varying circumstances. The copper ores smelted in South Wales are, for the greatest part, copper pyrites, mixed with iron pyrites, grey copper ore, &c.; in fact, a mixture in which the sulphurets of copper, iron, arsenic, antimony, cobalt, nickel, zinc, and tin, are invariably found together. The sulphur and arsenic escape from these ores during the calcining process, as sulphurous and arsenious acids, and have been found to destroy all vegetation for miles around the copper works, without affecting animal life in the slightest degree. By bringing the escaping fumes in contact with steam, and forcing it through burning charcoal, or subjecting it only to a great pressure in contact with steam, the new solid compound was deposited on the cool surfaces of the chambers connected with the calcining furnace. It

is deposited in beautiful crystallized leaves or tables, perhaps belonging to the same class as Wohler's dimorphic modification of the crystallization of arsenious acid, the regular form of which belongs to the octahedron, and is found to consist, in 100 parts, of

68.250	arsenious acid
27.643	sulphuric acid
3.029	protoxide of iron
0.420	oxide of copper
0.656	oxide of nickel
99.998	

Corresponding to	51.741	metallic arsenic
	11.095	sulphur
	2.339	iron
	0.336	copper
	0.516	nickel
	33.971	oxygen
	99.998	

These crystals attract moisture from the air with great rapidity and with evolution of heat, corroding animal and vegetable substances as powerfully as concentrated sulphuric acid. Their taste is pure, but powerfully sour, similar to sulphuric acid, and, dissolved in water, the remainder of 100 parts of these crystals is 17.436 grains only. The shape of the crystals is perfectly retained, only their appearance is changed from transparent into opaque. Their chemical composition was found to be,

16.778	grains of arsenious acid
0.656	oxide of nickel
17.434	

What the water had dissolved, consisted of

51.472	arsenious acid
27.643	sulphuric acid
3.029	protoxide of iron
0.420	oxide of copper
82.564	grains.

One of the remarkable changes during the formation of this compound, is the conversion of sulphurous acid into sulphuric acid, as well as the presence of iron, copper, and nickel, in a deposit from gaseous matter. No other definite compound of arsenic acid with another acid seems to be known, except those with the organic tartaric and paratartaric acids.

Why is the life of insects the briefest of all existence? Because the males rarely survive the inclemency of the first winter, and the females die after having deposited their eggs.

ON THE RELATION OF FORM TO CHEMICAL COMPOSITION.

(Read before the British Association, by Dr. Shafhaeutl.—From the Athenæum Report.)

The author stated that he had, in a former communication, given a new method of procuring graphite, in which it was also shown, that all graphites owed their origin to the operation of the same causes; namely, the contact of bitumen (or any similar substance) with a silica, under a certain limited degree of heat; it was farther maintained, that the compound nature of graphite might be satisfactorily demonstrated, by subjecting it to the action of hydrofluoric acid, which, combining with the silicon, liberated the carbon of the graphite as a hydruret, which was then consumed in the flame of a lamp. The object of the present paper was, to explain the circumstance under which certain modifications of form take place in this peculiar substance (as also in others generally considered to be elementary), and to prove their connexion with changes of an entirely chemical nature. A beautiful specimen of a formation of graphite was exhibited to the Section, obtained from the Neath Abbey Ironworks, in South Wales; it appeared to be composed of an infinite number of foliated scales overlapping each other, after the manner of the slates of a roof, each scale being so thin, as to be agitated by the slightest breath of air. A second specimen was exhibited of a graphite leaf, where it appeared as a globule of much greater size, the laminated structure still, however, existing in beautiful development. In a third stage, the scaly structure disappeared, the globule having assumed a more porous and coke-like form. Dr. S. having premised an objection to any explanation of these curious changes of form, founded merely upon molecular alterations, proceeded to detail certain experiments, from which he deduced conclusions of an interesting and important nature. The discovery of a new mode of decomposing crystallized graphite, by heating it in concentrated boiling sulphuric acid, and adding a little concentrated nitric acid (see a description in the *Phil. Mag.* xvi., xvii.), afforded a series of singular and instructive phenomena. After the evolution of binoxide of nitrogen had ceased, each scale of graphite was converted into the globular substance before described; its external metallic lustre remaining unchanged, but its bulk so greatly enlarged, that what before appeared a single scale, became, by the separation and division of its component la-

minæ, a thick spongy tissue, capable of being restored to its former compressed foliated form, by the pressure of the finger nail. That this change of form, however, was not merely a mechanical effect, appears from the following experiment:—Graphite scales having been repeatedly treated with hydrochloric acid, washed, and again digested in a strong solution of caustic potash, in order to remove all possible mechanical admixtures of iron, silica, and alumina, were then subjected to the process above described; the evolution of binoxide of nitrogen having ceased, an equal quantity of water was added to the mixture; immediately there succeeded a rapid evolution of bubbles from the globules of graphite, which at first lay at the bottom of the fluid; becoming lighter, as this evolution of bubbles proceeded, they gradually rose to the surface, when the gas immediately ceased to be evolved; the acid then, or the graphite, must have been combined with hyponitrous acid, which, being decomposed by the water, was disengaged as binoxide of nitrogen. The globules, when washed, dried, and weighed (at first weighing but 2.01 grs.) *had gained* 5.02 grs. in weight. Being then put into a flat covered dish of brass, and balanced accurately, the cover was removed, the globules immediately lost weight, and so rapidly, that in merely removing them from the dish, 0.18 grs. were lost; the dish was covered with a dew, apparently acid, as it acted on the brass. These globules, heated on paper until it became slightly tinged with yellow by the heat, now disengaged dense fumes, the paper being streaked with a blackish-coloured smoke, where it was in contact with the graphite; 2.30 grs. were lost during this process, which, being repeated a second time, they were found to have lost 2.25 more. Finally ignited in a platinum crucible, dense fumes, without any perceptible odour, escaped, the weight of the globules being reduced to 1.86 grs. After which, no farther reduction took place during ignition for half-an-hour in the open air. The total loss of the two grains thus experimented upon with the acid, was 6.96. In a paper by the author (see *Philosophical Magazine* cited above), this loss was attributed to evolution of carbonic acid during this conjointed action of the acids; but it would appear from the last experiment, that there is formed a compound of sulphuric acid, nitric acid, carbon, hydrogen, and oxygen, volatilized only at high temperatures. The question here arises, how can the rapid loss of weight be accounted for? During the previous drying process, which was conducted at 212°, the loss of water must have been accompanied by a change of chemical composition, and the new compound, by attracting water or oxygen when in the pan, must have formed an extremely volatile combination, evaporating as rapidly as it was formed. By a repetition of this treatment with the acid, graphite in the third stage, as before described, was obtained; the metallic lustre was entirely lost, as also the laminated texture; it now appearing as a porous mass, resembling coke, and no longer capable of reduction to its original foliated state by pressure, having undergone a decided chemical change. The acid solution deposited at once a copious precipitate of silica and alumina (slightly tinged by oxide of iron), upon the addition of ammonia to neutralization. A similar precipitate was obtained from the acid of the first experiments, but less in quantity, and requiring a longer time for its operation. Thus it would appear, that the abstraction of silicon and the change of physical properties of graphite, are corresponding and mutually connected phenomena.

(To be continued.)

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, November 18, R. D. Grainger, Esq., on the Nutritive Processes in Animals. Friday, November 20, R. D. Grainger, Esq., in continuation. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, November 19, W. H. Woolrych, Esq., on War. At half-past eight.

Franklin Mutual Instruction Society, Half-moon Alley, Lower Whitecross Street.—Monday, November 16, J. Smith, Esq., on the Acquisition and Communication of Knowledge. At half-past eight o'clock.

Chemical and Philosophical Society, No. 241, High Street, Shoreditch.—Wednesday, November 18, Mr. H. Wiglesworth, on Electricity. At half-past eight precisely.

Pestalozzian Academy, Worship Square.—Tuesday, November 17, Master Johnson, on Botany.

TO CORRESPONDENTS.

W. H.—*Chlorine (from* klorine) *is derived from a Greek word, signifying green.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by DOUDNEY & SCRYMGOUR (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

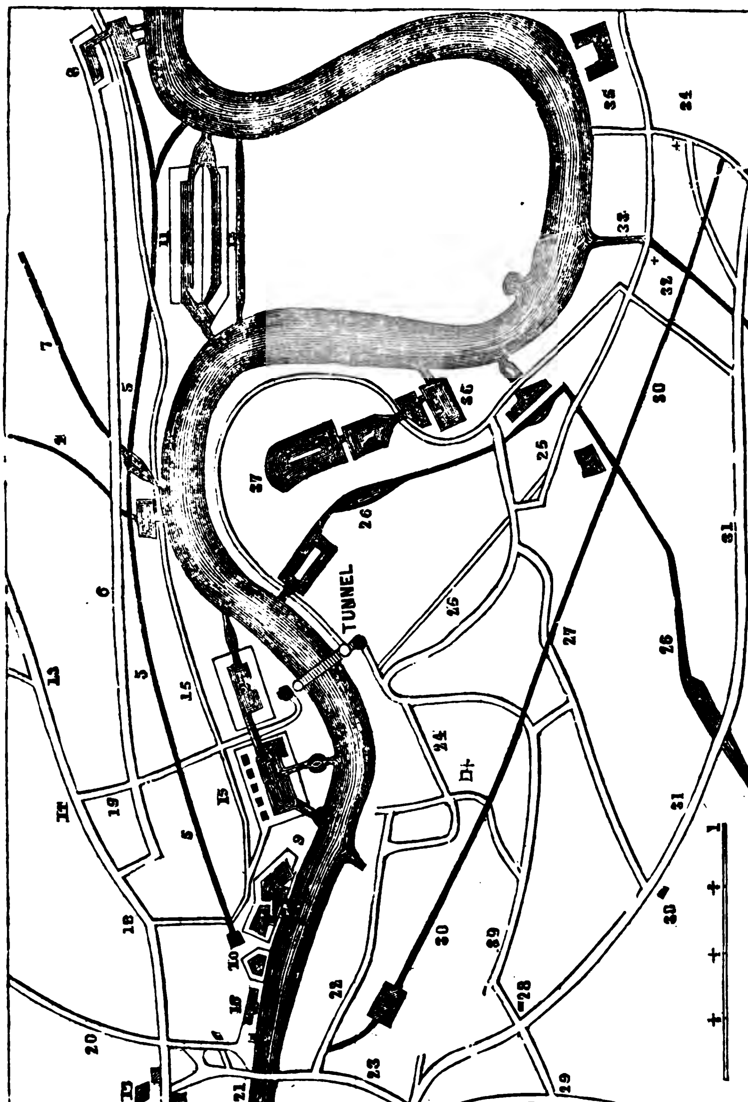
THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 120, NEW SERIES. | SATURDAY, NOV. 21, 1840. PRICE ONE PENNY. | No. 241, OLD SERIES.

THE THAMES TUNNEL.



City Press, 1, Long Lane: Doudney and Scrymgour.

THE THAMES TUNNEL.

(See Engraving, front page.)

WE feel it to be a duty we owe to the public, to express our gratification that this great national work will shortly be completed. The ears of most of us are so accustomed to the sound of the Thames Tunnel, that it has lost the charm of novelty; but could such a wonder be at once presented to us without our having any previous knowledge of its existence, we should, no doubt, flock by thousands to make sure that there really was a passage for carriages and foot passengers under the bed of a great river, over which thousands of vessels were daily passing and repassing; but we are not now left to mere speculation on the subject.

The effect on foreigners is such as we have attempted to describe; they have scarcely arrived in London, and deposited their portmanteaus at some hotel, but almost the first inquiry is for the Thames Tunnel; and off they go to gratify their curiosity, and to admire the skill and perseverance by which such a wonder has been accomplished; and we feel convinced that, could a whole nation of foreigners be at once transported to our country, the Thames Tunnel would be so crowded, that those wishing to see it would long have to wait for a turn. Is it not, then, surprising, that so many of our own countrymen remain in ignorance of the nature of this great work? Should we not, as a nation, be proud of it? It is, doubtless, the greatest work of art ever accomplished. For we may say, that it *is* accomplished, the excavation having been carried ten feet beyond high-water mark under Wapping Wharf.

The farther progress of the work in the Tunnel itself, is, for a time, suspended: and the workmen are now sinking the shaft to obtain access to the Tunnel on the Wapping side. This affords an excellent opportunity for the examination of the shield, well worthy the attention, not only of scientific men, but of all persons possessing the desire to see a piece of mechanism, by means of which so great a work of art has been carried on. We have no hesitation in saying—and, we believe, most scientific men will agree—that the chief merit of the engineer, who, by the accomplishment of this great national work, has surpassed all others, lies in the formation of this shield.

It may, perhaps, be as well to observe, for the information of those who have hitherto paid little attention to the subject, that this shield is a massive iron frame-work, the size of the excavation; in which the workmen stand and cut away the soil; the frame-work being in separate compartments, is moved forward, as room is made for each division. Thus it supports the top and sides of the newly-formed excavation. Hitherto the public have not been able to inspect the shield, as they could not approach it when the work was going on; had they been permitted to do so, it would not have been possible for them, while the mud and dirt were flying about, and the water oozing through in all directions, to form a correct idea of it; but now they may inspect it at their leisure without interruption. Not only are we to consider the grandeur of the work and the difficulty of the excavation, but it must necessarily prove of great utility, by establishing a communication between the parts of our great metropolis, where extensive manufactories are established, and almost in the centre of our unparalleled commerce. Having on the one side the London and the St. Katherine's Docks, and on the other side the grand Surrey Canal and the Commercial Docks. In such a position, what must be the interchange of weighty articles and people from side to side, now subjected to the inconvenience of passing round, about four miles, by London Bridge, or of embarking—crossing amid thousands of vessels, passing and repassing—encountering the dangerous swell produced by the numerous steamers; and, after accomplishing this troublesome passage, they are then subjected to the annoyance of landing on a muddy beach or upon dirty stairs. When the Thames Tunnel is completed, they will be enabled to pass on dry ground under the bed of the river, and the heavily-laden waggons will no longer be obliged to make the route referred to: in fact, it would be quite impossible to enumerate the extent and number of advantages that must result from this great work; an idea of which may be formed by reference to its position as pointed out in the annexed plate.

A project for a tunnel was put forth in 1799, but soon abandoned, which was followed by an attempt to form a tunnel from Rotherhithe to Limehouse in 1804; and in consequence of the great difficulties met with, it was suspended for a time; but at length a small drift-way was carried under the river to the extent of 923 feet, being within 150 feet of the opposite side, when the farther progress was considered impracticable, and the work, consequently, abandoned. Other plans for a tunnel were proposed, but not brought to maturity.

The present position of the Tunnel may be considered as the only one that could well be selected, without interfering with great establishments on either bank of the river.

In 1824, Mr. Brunel's plan for constructing, on a useful scale, a double and capacious road under the Thames, was commenced by building a shaft of brick-work, forty-two feet high, three feet thick, and fifty feet in diameter, at about 150 feet from the edge of the wharf; in which position this shaft was sunk, by excavating the soil within, by which means it sunk through a bed of gravel and sand, full of land water, forming a quick-sand, which had presented much difficulty to a former undertaking. The water and earth from this shaft were raised by means of a steam-engine erected on the top of it: this being completed, and a smaller shaft sunk as a well, the Tunnel was commenced at a depth of sixty-three feet from the surface; the engineer being prevented from going as deep as he otherwise would have done, by the assurance, that he would come in contact with a bed of sand. He was unable to obtain a thicker stratum between the river and upper part of Tunnel, by which it seems probable, that the inundations which interrupted the work for a long time, and occasioned a vast expense, would have been avoided.

The excavation made, is thirty-eight feet broad, and twenty-two feet six high. The shield, already alluded to, by which this extensive excavation has been effected, consists of twelve large iron frames, lying close together, like books on a shelf. These frames are twenty-two feet high, and about three feet broad; they are each divided into three stages, thus forming thirty-six places for workmen. This shield not only serves for the excavators, but also for the bricklayers, who carry on their work at the same time. Towards the head and foot of the shield, there are horizontal screws attached to each of the divisions, and screwed so as to press against the finished brickwork, thus forcing the division forward as the workmen clear a way for it. There is also a moveable stage, with two floors, for the miners and bricklayers to place their material. A mass of brickwork, forming two arches, is carried on simultaneously with the excavation, having a middle wall of four feet solid work, with a succession of arches in it, forming a communication between the two carriage ways.

The access for carriages will be by circular road-ways, 200 feet in diameter, the declivity of which will not exceed four feet upon the hundred. There being two carriage roads, the carriages will pass through one road in going one way, and the other when going the contrary way; so that there is no danger of contact. The foot passenger will also have the advantage of the shafts; one of which on the Rotherhithe side was the first sunk, and has long been used.

Description of Engraving.

1. Tunnel.	20. Bishopsgate Street.
2. London Docks.	21. London Bridge.
4. Regent's Canal.	22. Tooley Street.
5. Blackwall Railway.	23. Borough.
6. Commercial Road.	24. Jamaica Row.
7. Limehouse Cut.	25. Deptford Lower Rd.
8. East India Docks.	26. Grand Surrey Canal.
9. St. Katherine's.	27. Blue Anchor Road.
10. Tower.	28. Bricklayers' Arms.
11. West India Docks.	29. Elephant and Castle.
12. City Canal.	30. Greenwich Railway.
13. Road to Hackney.	31. Kent Road.
14. Mile End.	32. Deptford.
15. Ratcliffe Highway.	33. Creek Bridge.
16. Custom House.	34. Greenwich.
17. Bank.	35. Royal Hospital.
18. Aldgate	36 & 37. Commercial Docks.
19. New Road.	

THE BRITISH PATENT LAWS.

We are constantly receiving applications from inventers for advice to enable them to secure to themselves the advantages to which they are in justice entitled, but which the law withholds from all who are not prepared to purchase its protection at an exorbitant price. We extract the following from a correspondent (A. Z.):—

"I have invented several things, such as a carriage upon an inch scale, of the Birmingham pattern, that will run the sharpest curve that is upon any railway, without that friction upon the edges of the rails—the hind wheels always running in the same track as the fore ones make, turning either to the right or left. Each wheel is firmly fixed upon the axle, and yet they can run, some backwards and some forwards, at the same time, if required; so that the outer can travel the outer circle with perfect ease, while the inner ones stand comparatively still; will run a circle of twenty-four inches, either on the rails or upon the top of a table, without the smallest difficulty; the springs so placed as to do all the work of the present carriages, and only half the weight of metal now used, so that the passengers ride just as easy again as they do at this time. I have attached to the carriage a self-acting break or clog for the wheels; so that when a collision takes place, running down the engine, it cloggs the wheels of as many

carriages as have it fixed to them; then, as soon as they feel the draft of the engine, it relieves itself of the same. It is supplied with a small apparatus to make its own announcement at any place that may be thought expedient, without the engineer or passengers knowing anything about it. Say a train is expected from Birmingham at a certain time, just time for the policeman to get his breakfast; but, by some means, it arrives ten minutes sooner, and before it reaches the tunnel, Primrose Hill, half-a-mile or a mile, will make its own announcement in the room where the policeman is sitting, at Chalkfarm depot. My carriage is so constructed, that should there be anything lying upon the rail that would throw the carriages off, it would still keep on. I have also a rail and a chair for ditto, to lay in upon sleepers, that lies much firmer than any I have yet seen; and no engine upon the Birmingham line or carriage will run off; and, when worn for ten years, may turn it upside down, and wear a new side. Only one thing more I will mention at this time, least you think I am making false statements; but this I will not do if I know it. I am now putting an apparatus to one of my carriages, that, if the guard of the train is allowed to ride upon the carriage next to the tender, and seeing any danger, he can, in one moment, detach the engine and tender from the train, and stop the four or all of the wheels of the first carriage, and then the self-acting break will stop the rest. These little things I would gladly give up to any railway company for a permanent situation."

It cannot be expected that every communication of this nature, speaking only of results, without exhibiting the means of obtaining them, should occupy the columns of the "Mechanic;" but, at the same time, it should be recollected, that useful mechanical inventions, however profitable they may be to the projector, are equally, or more so, to the community at large. It is undeniable, that the commercial prosperity of this country has been materially advanced by such inventions; and it is equally true, that many of them have emanated from men who possess but a scanty share of scientific knowledge. Genius and industry can achieve great things; and their suggestions ought not to be discarded or contemned on account of their not being expressed in the elegant diction of science.

The oppressive Patent Laws, of which we now most especially complain, are but a branch of that poisonous upas tree whose deadly shade withers the tender plants of unprotected merit and genius. The great fundamental evil is the undue favour accorded to wealth; the powerful are protected, and the feeble are left defenceless; wealth is rewarded and poverty is abandoned or plundered. There is scarcely a lucrative place in any public office, which may not be obtained by money and intrigue; and appointments and preferments in the army, are bought and sold as shamelessly as cattle are bought and sold in a public market; so that any rich booby, who is qualified as a dandy and a sycophant, can, in a few hours, become a military commander, to the manifest prejudice and injury of those whose claims are founded only on merit and faithful discharge of duty. We shall at present, digress no farther from our main object; but we are anxious to show, that inventers are not the only class unfairly dealt with—in order to induce those who have no immediate interest in the establishment of equitable patent laws, to unite their exertions with those of the more directly interested, and thus acquire a claim of reciprocal aid, when their own immediate interest shall require it. We appeal for assistance to every mechanics' institute, and every scientific association in the kingdom (except the Royal Society, which has sworn to give no opinion upon anything); and we implore all well-wishers to their country, and all friends of justice, to examine the subject, and be prepared, when the time shall come, to join in petitioning the Legislature for redress. We are far from desiring that wealth should be deprived of its legitimate influence; when fairly acquired, and securely held, it is power in itself, and needs no assistance from the Legislature to increase its weight. If a man be but rich, says Democritus (Robert Burton), all men's eyes are upon him; "God bless his good worship! his honour! Every man seeks his acquaintance, his kindred, though he be an aufe, a ninny, a monster, a goose-cap, *uxorem ducat Danaen*, when and whom he will; *hunc optant generum, rex et regina*—he is an excellent match for my daughter, my niece, &c.; every man is willing to entertain him; he sups in Apollo wheresoever he comes. What preparation is made for his entertainment! Fish and fowl, spices and perfumes, all that sea and land afford. What cookery, masking, mirth, to exhilirate his person! What dish will your worship eat of? What sport will your honour have? Hawking, hunting, fishing, fowling, bulls, bears, cards, dice, cocks, players, tumblers,

fiddlers, jesters, &c.—they are at your good worship's command." So it ever was; and while human nature remains what it is, so it ever will be; and all this, and a thousand secret intrigues which money alone can conduct, belong to wealth, and need no exclusive and oppressive laws to secure them. Let them enjoy all the good things, the adulation, and sham friends, that riches can purchase; they are welcome to them; but do not take from poor industrious men, that which in justice belongs to them. We ask no favour, we demand justice; and, sooner or later, we shall have it. Where is the man that will lay his hand on his heart, and say that he believes it to be right that no talent, no invention, however valuable it may be in itself, should be rewarded or protected, if the inventer cannot raise 350*l.*, and allow himself to be robbed of all that money? No man of common sense and common honesty can do it. The simple, honest working man, does not covet the estates of the magnates of the land; he knows that he is as happy, or happier than they are, if he can but "keep the wolf from his door." A man is as wet in a bath, as he would be if plunged into the ocean; and if he has something that he likes for dinner, and plenty of it, he is as well fed as my Lord Mayor or my Lord Melbourne. Pyrrhus would first conquer Africa and then Asia, *et tum suaviter agere*—and then live merrily and take his ease; but when Cineas, the orator, told him he might do that already, *id jam posse fieri*, rested satisfied, condemning his own folly. We are only proclaiming the sentiments of the honest mechanics of this country, when we declare that we neither ask nor desire any favours from the hands of the rich; we demand justice, and WE WILL HAVE IT, if the supineness of those for whose benefit it is claimed, does not induce indifference or opposition in another quarter.

THE CENTRIFUGAL ESCAPEMENT.

To the Editor of the Mechanic and Chemist.

SIR,—I am a constant reader of the "Mechanic and Chemist;" and when your last week's Number came to hand, I was very much surprised to see an invention of mine (namely, the "centrifugal escapement"), with the name of "J. Paterson" attached to it. Now, Mr. Editor, allow me to inform you most respectfully, that this "J. Paterson" did not invent the centrifugal escapement, nor any part of it. The facts of the case are these:—J. Paterson was in my employment at the time I was constructing the first model of the invention, and, as he worked beside me in the same apartment, I was obliged to let him see it, and had his promise that he would keep the secret. You see how he has kept that promise. Since then, the invention has undergone many improvements which he knows nothing of; and the objection that you, Mr. Editor, have mentioned in your note at the end of his description, is entirely done away with. I would have here given a full description of the clock in its present improved state, but I have sold it; and as it is now the property of others, it would not be fair to do so without their concurrence. Hoping that you will insert this in your next Number, I remain yours respectfully,

A. BAIN.

35, Wigmore Street, Cavendish Square, Nov. 10, 1840.

[Mr. Bain describes his invention as follows:—"This time-keeper is made upon the principle of centrifugal force and gravitation, acting in opposite directions to each other upon two revolving balls, which are seen (within the ring) upon the top of the clock. The first peculiarity of this clock is, that the time-keeping or regulating parts revolve continually in one direction in a circle around their centre; thereby imitating more closely the motions of the heavenly bodies, from which our time is taken, than either the pendulum or balance, these having vibratory motions. Secondly, the balls or regulating parts are quite detached from the mechanism of the clock, except about two seconds each minute when they are receiving their impetus, thereby reducing the friction to less than one-tenth of ordinary escapements. Thirdly, there is a principle in this escapement itself, whereby the balls will only take one certain quantity of power from the main-spring each minute, thereby preventing any irregularities that might be in the main-spring, or of the clock mechanism, to affect its going." This allusion to the motions of the heavenly bodies, is mere *ratiocinatio verbosa;* a discourse upon words, unconnected with facts. In our former remarks upon this escapement, we said that it could not produce a true measurement of time; we say so still, and will give our reasons for maintaining that opinion. In examining the construction of any mechanical combination or machine, it is expedient to divide the investigation into two distinct parts: first, considering the principle, and calculating its result as it would be, if unaltered by imperfections in execution, and other external influences; and then, esti-

mating the amount of external impediments, and the means of compensating or counteracting their effects. Now it will be seen that the centrifugal escapement is dependent upon friction and other essentially variable and uncertain elements for the performance of its proper functions; and the motion of the machine is subject to corresponding variation with every alteration which may, and unavoidably will take place in those inconstant actions. Suppose all friction, atmospheric resistance, and other obstacles to be removed; the balance, once put in motion, would continue to revolve uniformly for an indefinite period, and the detent would never be liberated, and, consequently, the motion of the clock would be arrested; but introduce the friction on the pivots of the balance, the resistance of the air, &c., and the action of those impediments will retard the velocity of the balance till the weights descend and liberate the detent, which confines the maintaining power. It is clear, that the time employed in producing this given quantity of retardation, is wholly dependent on the intensity of the resistance; and the agency of such uncertain elements is utterly inadmissible in the construction of an accurate timekeeper. A clock upon this principle is now exhibited at Messrs. Hunter and Edwards', Cornhill, London.—Ed.]

THE CHEMIST.

ON THE RELATION OF FORM TO CHEMICAL COMPOSITION.

(Concluded from p. 240.)

In farther proof of the necessary connexion of silicon as a chemical combination, essential to the existence of the scaly metallic lustre of graphite, it will be found that, by repetition of the same experiments, the globules ultimately disappear, and the remaining solution in acid neutralized by ammonia, deposits only flaky silica, with traces of oxide of iron. On observing attentively the specimen of graphite, as found in its natural state, and comparing it with those treated with acids and alkalies, also exhibited, it appeared that the scales, before being operated on, had a dirty greyish appearance, described as owing to their being covered with spots, consisting of microscopic six-sided flattened prisms of silicate of iron; the matrix of this graphite formation, in the blast-furnace cinder, essentially composed of bisilicate of lime and alumina, deriving a yellowish tint from a slight admixture of sulphuret of calcium, with a trace of sulphuret of potassium. Scales of very different density may be separated, the thinnest unaffected by the magnet, the thicker ones decidedly so; those in the middle of the mass thicker and stiffer, not easily broken, and showing a shining black fracture, like that of anthracite, form a variety of graphite, in which silicon and iron are greatly predominant, developing, when treated with hydrochloric acid, a fetid hydrogen, characteristic of cast iron, and separating at the same time yellow flocks of silica and alumina. Dr. Schafhaeutl then proceeded to point out an analogy between the formation of grey iron in the blast furnace and that of graphite; namely, that the same chemical conditions occur during the change of white iron into grey; this takes place after having descended through the furnace, and reached the stratum of slag covering the melted metal; the slag being an earthy bisilicate (in coke furnaces, approaching to a trisilicate), and containing a small quantity of protoxide of iron. As silicon is found in graphite only in very small quantity, it has been considered an accidental impurity, just as the small quantity of hydrogen retained by charcoal, sulphur, &c., has been considered an impurity; but as these foreign matters can by no chemical means be separated, without destroying the state in which graphite, charcoal, and sulphur exist, it must be inferred that such admixture is essential to their existence in that state in which they ordinarily appear. Quitting now the individual consideration of graphite, the author extended the principle here argued to certain other substances, considered generally as simple bodies. For example, sulphur obtained by the decomposition of sulphurets by acids, is white in colour, and invariably combined with a stable quantity of hydrogen. But, obtained from hyposulphites, it is as invariably yellow, and the presence of free hydrogen in the slightest quantity, bleaches the precipitate. The known case of sulphur precipitated under the presence of sulphuretted hydrogen, and cautiously mixed with metallic copper in its utmost state of minute division, being found to combine directly, evolving a dull red heat, has been considered an exception to the law, that no two dry bodies unite without the intervention of a third; but sulphur, precipitated from hyposulphites, will not thus combine, nor will pure sulphur, though subjected to the minutest division possible. The same sulphur, however, brought into contact with hydrogen, under a pressure of four atmospheres, and then quickly mixed, is found

to combine, as in the first instance; but if exposed to the air, its power of combination is again lost: thus, a third body is proved necessary here, as in all cases. And farther, the author doubted if one of the two different crystalline forms of sulphur is not owing to the presence of hydrogen, which he found to be in combination with it in a very perceptible quantity. These peculiar forms of combination, where a few atoms of one body are combined with a high number of atoms of another, may be considered, perhaps, as forming a class of compounds intermediate between the inorganic and the higher organic compounds; thus, the compounds of arsenic acid form a very striking example. In the subarseniate of iron, fifty atoms of iron are combined with only three atoms of arsenic acid and seventy-five of hydrogen. So again, twenty-four atoms of arsenic with one atom of sulphuret of potash in sulph-arseniate of potash. By gradually passing from compounds of inorganic chemistry to those of organic chemistry, we find diacetate of copper with water; forty-eight atoms of oxide of copper combined with only one atom of hydrogen, and twelve atoms of water. And, finally, in the field of organic chemistry itself, we have, for example, margaric acid, composed of sixty-seven atoms of hydrogen, thirty-five carbon, and three of oxygen only. In the oleic acid, 120 atoms of hydrogen are combined with seventy of carbon and five of oxygen; in the stearic acid, 134 atoms of hydrogen with seventy of carbon and five of oxygen, &c. The author hinted in his paper in the *Philosophical Magazine*, that the principal circumstance which tended to produce compounds of such multiplicity of atoms, or, in fact, organic compounds, was the separation of the molecules of bodies brought into action by the capillary powers of the vessels of organic structures. It was probable that the chemical action of these separated molecules must be a different one, from their action, when arranged into one definite form; and, as a proof that once-received laws of affinity were exhibited only under peculiar circumstances, he directed the attention of the Section to H. Rose's compound, formed by direct combination of 29.97 per cent. of ammonia, with 70.03 per cent. of sulphuric acid, which ought to have produced anhydrous sulphate of oxide; but after combination, neither sulphuric acid nor ammonium could be detected in the compound. The same chemist found combinations of anhydrous sulphuric acid with the chlorides of ammonium, potassium, sodium, and the nitrate of potash. According to the laws of affinity, for example, in the last case, the nitric acid ought to have been displaced, decomposed, and driven away by the more powerfully-acting sulphuric acid; but no tendency whatever was shown to the displacement of chlorine or nitric acid, and new compounds, different from all hitherto known, resulted. As no combination of anhydrous sulphuric acid took place at all with oxide of calcium, chloride of barium, or chloride of copper, he concluded, that these above-mentioned combinations were formed only by replacing one double atom of hydrogen water or chlorine, in order to form a bisulphate of potash, soda, or ammonia. The author seemed to believe, that there existed two different states of chemical combination: the first in which the chemical forces of molecular attraction were acting only according to the relative quantities of matter; the second, where, under the always catalytic presence of a third, the elementary substances arranged themselves, separating in groups according to the resultant electric forces of the centres of action created by the above-mentioned presence of a third, acting differently on the different molecules of bodies in contact, in a somewhat similar way as a solution, which does not crystallize, unless the molecular equilibrium of the liquid is disturbed. The first state of chemical combination might, perhaps, have some distant relation to Dumas's law of types; the second state, a mere consequence of the first, would be represented by Berzelius's electro-chemical combination. The author, at the same time, referred to Prof. Graham's admirable papers, in which the Professor had so distinctly pointed out the great and peculiar part which matter performs in chemical solid combinations, and remarked, that during all chemical combinations where a third body is separated, the precipitation only would take place, when a certain quantity of water combined with the body to be precipitated, which water separated in the relation to the separation and consolidation of the precipitate only, and could be driven away from it only by applying a red heat.

MISCELLANEA.

Novel and Extraordinary Phenomenon.—Accident has led to the discovery, that the steam which escapes from the boilers of steam-engines, in many cases develops or gives out great quantities of electricity. About a fortnight since, the engine-man at a stationary steam engine on a railway in the neighbourhood of Newcastle, hap-

pening to have one hand in a copious jet of steam, which escaped from an accidental aperture in the boiler, whilst he applied his other hand to the lever of a safety-valve, experienced an electric shock. This led to the discovery, that electricity was given out by the steam with great rapidity, and might be collected as from a powerful electrical machine. It has been ascertained, moreover, that the phenomenon does not arise from any circumstances peculiar to the boiler in which it was first observed; for in many other boilers, which have since been tried, the steam has been found to develop electricity very copiously. The subject is being followed up here by experiments, and has been brought under the notice of some of the most scientific men of the day. It is not unlikely that the newly-discovered phenomenon may lead to important results, in advancing our knowledge of the nature of the subtle and mysterious fluid, and form an era in the history of electrical science.—*Northern Star.*

Railway Accidents.—As the number and extent of railway lines of road increase, it must be expected that a proportional increase of accidents will take place, unless some remedy be discovered that will insure safety, either by mechanical construction or improvement in the administration and selection of the persons employed. A correspondent of the *Railway Times*, alluding to a suggestion for placing a truck at the back of every train, as a protection against collisions, recommends, as an additional security, "a shield of adequate strength, having attached to each side of it one or more coiled springs, like the mainspring of a watch. This machinery to be affixed to a luggage or goods-waggon at each end of the train of carriages. The effect of this, I imagine, must be to exhaust the force of any collision, in a circular direction, and prevent the impulse on the carriages. Perhaps if you publish this hint to the mechanical and railway world, something may arise out of it. This would be too cumbrous as a defence to each of the carriages in the train; but something more might surely be done, by means of springs, than is done, to mitigate the concussions of the carriages with each other, when any obstacle occurs within the line of the train itself, as in the Hull and Selby case. No care on the part of the management can prevent accidents arising from the negligence, perverseness, or indiscretion of voluntary agents, nor always from other causes. No mechanical contrivance, therefore, ought to be neglected, to prevent the lamentable consequences of such accidents when they do occur."

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, November 25, R. D. Grainger, Esq., on the Nutritive Processes in Animals. Friday, November 27, R. D. Grainger, Esq., in conclusion. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, November 26, Mr. Whitney, on the National Varieties of the Human Species. At half-past eight.

Franklin Mutual Instruction Society, Half-moon Alley, Lower Whitecross Street.—Monday, November 23, Mr. O. Vidler on the Comic Literature of England. At half-past eight o'clock.

Chemical and Philosophical Society, No. 241, High Street, Shoreditch.—Wednesday, November 25, Mr. James Smith—Discussion: Is Novel Reading Commendable? At half-past eight precisely.

Pestalozzian Academy, Worship Square.—Tuesday, November 24, Mr. C. Lane—Is Development the Ultimate Aim in Education?

TO CORRESPONDENTS.

S. G. *may see Simon's blocking machine at No. 14, West Row, Regent Street. It is a French invention, patented in England as well as in France. In the opinion of respectable manufacturers, the fronts blocked by this machine, are superior to those made by the old manual process.*

T. Hedgcock.—*The drawing is not sufficiently distinct to insure an accurate execution of the engraving. Diagrams of this kind should be drawn of the proper size, and in every respect as they ought to appear in the engraving.*

A Subscriber *may procure the circular steel plates, similar to those used for circular saws, at any of the tool-shops where Sheffield goods are sold, but they must be made to an especial order.*

L. S. *will find instructions for taking a cast from the human face in No. 86, N.S.*

W. C.—*The works he mentions do not contain the tables of logarithms he requires. We will endeavour to supply him with the information he desires.*

G. A.—*Seidlitz powders may be made as follows:—Three drachms of Rochelle salts; twenty-six grains of carbonate of soda; twenty grains of tartaric acid.*

S. C., Weymouth.—*The letter he refers to has not been received; if he will favour us with another communication, we shall feel obliged.*

G. L.—*The copies of medals obtained by the electrotype from a solution of the sulphate of copper, are compact masses of copper, and may be treated in the same manner as if cast or stamped.*

A. B.—*Spirits of wine is preferable to oil for burning in a lamp used only for the production of heat, as it produces no perceptible smoke.*

A. S.—*A very small power is sufficient to prevent a person from sinking in the water; a cubic foot of air has a power of buoyancy exceeding 60 lb.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by DOUDNEY & SCRYMGOUR (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 121, NEW SERIES. | SATURDAY, NOV. 28, 1840. PRICE ONE PENNY. | No. 242, OLD SERIES.

THE WINDOW WHIRLIGIG.

FIG. 1. FIG. 4.

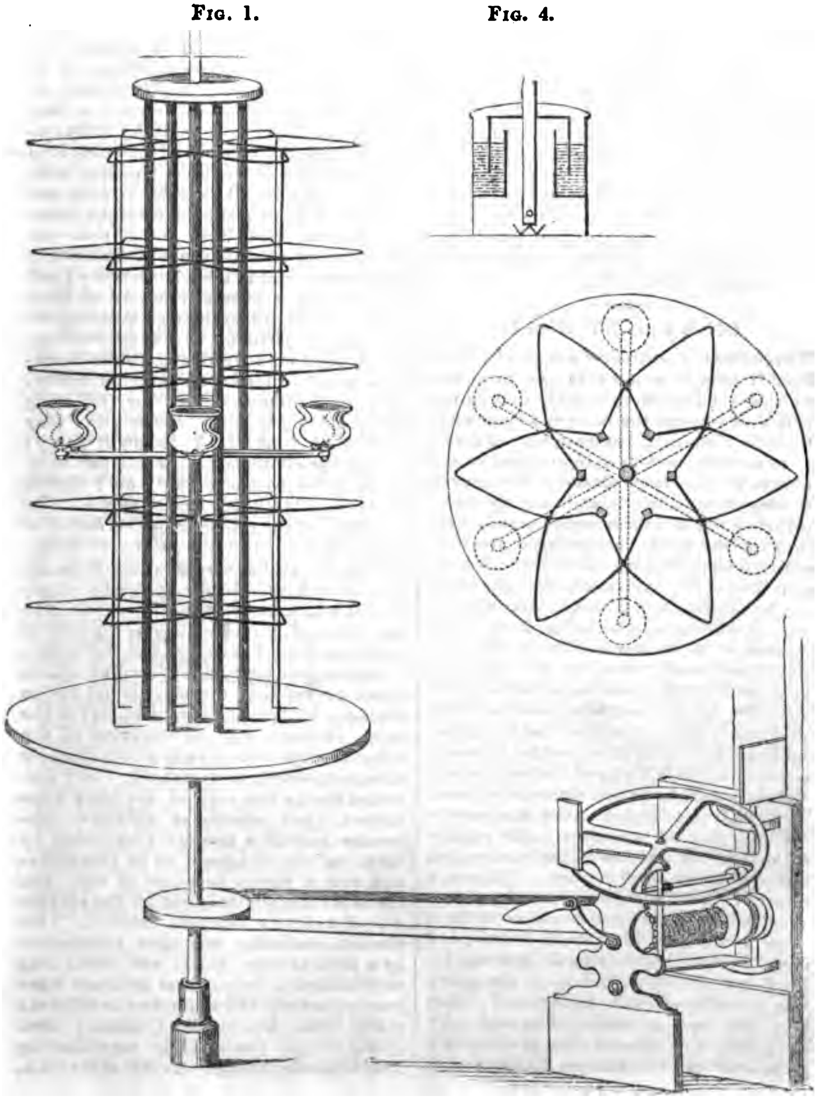


FIG. 3.

FIG. 2.

City Press, 1, Long Lane: Doudney and Scrymgour

THE WINDOW WHIRLIGIG.

Among the various methods to which tradesmen resort in order to call the attention of passengers to their shops, we meet with the following very singular mode (shown in our front page) at 97, Fleet Street, for the exhibition of fancy waistcoats. The revolving motion of from 200 to 300 patterns, together with the gas-lamps, produces a very novel effect, and attracts the attention of multitudes. The above, we are informed, was manufactured by Mr. W. Mornington, of No. 5, Frederick Place, Hampstead Road.

Description of Engravings.

Fig. 1 shows the elevation of the machine. Fig. 2, the apparatus by which fig. 1 is worked. The axle is acted upon by means of weights; the handle seen in the figure being used to wind it up afresh. Fig. 3, a transverse section, exhibiting the six globular gas lamps, working upon the centre, as seen in fig. 1, and supplied from the upright tube, running through a metre, as represented in fig. 4.

ON RADIANT HEAT.

The following abstract of a report by Prof. Powell (supplementary to one furnished to the Association in 1832), though not sufficient to form the basis of an unexceptionable theory, has, at least, tended greatly to modify previous opinions, and to enable us to refer large classes of phenomena to something like a simple and common principle. The former report was divided into various heads, according to the then existing state of our knowledge; but recent discoveries have so changed our views on the subject, that these divisions cannot, with any advantage, be adhered to. The researches to be described may be classed under two heads: first, as they relate to heat in its *ordinary* or *unpolarized* state; secondly, as they relate to *polarized heat.* The report then entered on the first general head, by calling attention to the recent researches of Melloni and Forbes respecting the *transmission* and *refraction* of heat. The professor adverted to the discovery of Melloni, that the resistance to the passage of heat is *not* exerted at the surface, but in the interior of the mass. This was a result of the observation, that the difference between the transmission of heat from a more highly-heated source, and from a less highly seated source, became less as the thickness of the screen was diminished, and disappeared when very thin screens were interposed. By comparing the transmissive powers of a great number of substances, he found that in crystallized bodies the diathermaneity for the rays of a lamp was proportional to their refractive powers; but in uncrystallized bodies no such law could be traced. It was in the course of these researches that Melloni made the important discovery of the singular property possessed by rock salt—viz., that it is almost entirely permeable to heat, even from non-luminous sources. He found its transmissive powers six or eight times greater than that of an equal thickness of alum, which had nearly the same transparency and refractive power; and that, unlike other diathermanous media, it is *equally* diathermanous to every species of heat—i. e., whether from sources highly heated or moderately heated: thus he found a plate of seven millimetres (.28 inch) thick, to transmit ninety-two out of one hundred rays, whether from flame, red-hot iron, water at 212° or at 120° Fah. A plate one inch thick gave a similar constant ratio: the general conclusion being, that the source being a lamp, the diathermancy is not proportional to the transparency; and he makes some general remarks on these results, as related to those of Seebeck, on prismatic dispersion. In a supplementary paper, Melloni investigates the modifications which calorific transmission undergoes in consequence of the radiating source being changed. He employs four sources of heat—1. A Locatelli lamp; 2. Incandescent platina; 3. Copper heated by flame to about 730° Fah.; 4. Hot water in a blackened copper vessel. The discovery of the complete diathermancy of rock salt furnished the means of prosecuting the author's researches on the refraction of heat. In the successful experiment which he made, he concentrated in the focus of a rock salt lens, the rays of dark heat from hot copper and hot water. A similar lens of alum produced no effect, which proves that the effect is not due to the mere heating of the central part of the lens. In discussing the properties of the calorific rays immediately transmitted by different bodies, a remarkable effect presented itself: the rays of the lamp were thrown upon screens of different substances in such a manner that, either by changing the distances, or by concentration with a mirror or a lens of rock salt, the effect transmitted from all the sources was of a certain constant amount. This constant radiation was then intercepted by a plate of alum, and it was found that very different proportions of heat were transmitted by the alum in the different cases; from whence he (Melloni) concludes, "that the calorific rays issuing from the diaphanous screens are of dif-

ferent qualities, and possess (if we may use the term) the diathermancy peculiar to each of the substances through which they have passed." He next investigated the effects of *coloured glasses*, and concludes, that all the coloured glasses, except green, produce no "elective action" on heat: green glass, on the contrary, transmits rays more easily stopped than the others; and that green glass is the only kind which possesses a coloration for heat (if we may use the term), the others acting upon it only as, more or less, transparent glass of uniform tint does upon light. From experiments upon the solar rays transmitted by green glass, and intercepted by other media, he found they passed copiously through rock salt, but feebly through alum; whence he concludes, that there are among the solar rays some which resemble those of terrestrial heat, and, in general, that the differences observed between solar and terrestrial heat, as to their properties of transmission, are, therefore, to be attributed merely to the mixture in different proportions of these several species of rays.

Professor Forbes repeated and extended Melloni's experiments on the transmission and refraction of heat. One of the most interesting points to which he directed his attention, was the possibility of *detecting heat in the moon's beams*. These, concentrated by a polyzonal lens of thirty-two inches diameter, and acting on the thermo-multiplier, gave no indication of any effect; so that Professor Forbes considers it certain that, if there be any heat, it must be less than the $\frac{1}{300000}$th part of a degree Centigrade. In his third section he investigates the index of refraction for heat of different kinds, as compared with that for light in the same medium. The method of observation adopted was indirect, depending upon the determination of the critical angle of total internal reflection in a rock salt prism, with two angles of 40° and one of 100°. By an ingenious mechanical contrivance, the sentient surface of the pile was made to receive rays coming from the source of heat, after undergoing two refractions and one reflection, whatever was the angle of incidence. The results, which were but approximate, were as follows:—

Source of Heat.	Index of Refraction for Rock salt.
Locatelli lamp	1.521
Ditto transmitted through alum	1.548
Ditto .. glass	1.537
Ditto .. opaque glass	1.543
Locatelli lamp transmitted through opaque mica	1.533
Incandescent platina	1.522
Ditto transmitted by glass	1.538
Ditto .. opaque mica	1.534
Brass at 700°	1.518
Ditto transmitted by clear mica	1.527
Mercury at 450°	1.522
Mean luminous rays	1.552

The results deduced are:—

1. The mean quality, or that of the more abundant proportion of the heat from different sources, varies within narrow limits of refrangibility.

2. These limits are very narrow, where the direct heat of any source is employed.

3. All interposed media (including those impermeable to light), so far as tried, *raise* the index of refraction.

4. All the refrangibilities are inferior to that of the mean luminous rays.

5. The limits of dispersion are open to farther inquiry, but the dispersion in the case of sources of low temperature, appears to be smaller than that from luminous sources.

Prof. Powell dissents from the opinion of Ampère, that the difference between heat and light is to be accounted for by the difference of wave length on the undulatory hypothesis. During these researches, he found that a certain kind of green glass, coloured by oxide of copper, though it permitted a portion of luminous rays to pass, absorbed all the calorific rays; so that it exhibited no calorific action, capable of being rendered perceptible by the most delicate thermoscope, even when so concentrated by lenses, as to rival the direct rays of the sun in brilliancy. With respect to the transmission of heat by screens, Professor Forbes remarked, that Melloni's view of the transmission of heat of low temperature, by all substances alike, is equivalent to saying, that substances in general allow only the more refrangible rays to pass; or that while rock-salt presents the analogy of white glass, by transmitting all rays in equal proportions, every substance hitherto examined acted on the calorific rays as violet or blue glass does on light, absorbing the rays of least refrangibility, and transmitting the others only. To this rule, Melloni made out the first exception, or the first analogue to red glass—rock salt with its surface smoked. And Professor Forbes soon after pointed out another—viz., mica split by heat into numerous fine laminæ, and from thence, as the effect was obviously mechanical, since unlaminated mica pro-

duces no such effect, he concludes that the smoked surface of the rock salt acted also mechanically, and was thus led to try the effects of surfaces variously altered by mechanical means, and thus effects, in some distant degree analogous to *sifting* the heat, were observed. Fine powders also sifted on the surface, were found to affect the transmission of heat; and these Prof. Forbes considered analogous to diffraction and periodic colours in light. From these important researches, we have learned to connect modifications in the transmission of heat with the quality of refrangibility, and not, as heretofore, with a supposed difference of quality depending on the *source* of the heat.

In November, 1834, Prof. Forbes took up the subject and obtained complete success. He succeeded in polarizing heat from various sources, and by the aid of various substances, as piles of plates of mica, and by reflection and refraction, and showed that the peculiar modification of the experiments adopted by Berard, by reflection from glass, the quantity even at the maximum which could reach the thermoscope after two reflections, would be so extremely small, as that no difference of effect in the two rectangular positions could really have been perceptible. The report contained some remarks on the clearness with which the chronological order of the discoveries is marked in this case, and the consequent impossibility of any of those disputes which have sometimes tended to disturb the harmony of scientific inquiries. The Continental philosophers have the merit of devising and bringing to perfection the instrument, by the aid of which alone, any discoveries in this very delicate field of research could have been expected. Professor Forbes is the author of the discovery of the polarization of heat in all its branches, and from all its sources. The report concluded, by drawing attention to the difference which exists between Prof. Forbes and the Continental philosophers, as to the equal or unequal polarization of heat from different sources, and to the speculations respecting the cause of the variety of action of light and heat on our organs of sense, while both originate in undulations of the molecules of the same ethereal medium.

WIRE ROPE FOR SHIP'S RIGGING.

Those of our readers who are acquainted with nautical affairs, are, no doubt, aware, that during the last few years, iron has very generally superseded rope, in such parts of a ship's rigging as are permanent and not subject to friction. In steamers, the use of iron as a substitute for rope, has, of course, been carried to a greater extent than in sailing vessels; but it promises to be much more extensively employed than ever, in consequence of the adaptation of a wire to the purposes of the small descriptions of rope. The advantages to be obtained are, that the rigging of wire is smaller and lighter than that of rope, and, as it offers much less resistance to the wind, is of great advantage in beating to windward. The cost, too, is much less, and the durability greater. In several trials lately made at Liverpool, the following results were obtained:—

1 inch wire broke at	2 tons	1 cwt.
$1\frac{1}{2}$	5 —	0
$2\frac{5}{8}$	8 —	14

Other sizes were also tried with proportional success; and, it should be remarked, that a three-inch hempen rope, of the best quality, broke at two tons one cwt. Another good quality of the wire, is its elasticity, which, though not, of course, equal to that of hemp rope, is quite sufficient to counteract the effects of a sudden jerk, while a vessel is rolling heavily at sea. One comparatively short length of wire rope that was tried, stretched $18\frac{1}{2}$ inches before it broke. A very short length of $1\frac{1}{2}$ inches diameter, stretched six inches. The machine on which the tests were made, is very ingenious, and of tremendous multiplying power: it is that on which iron cables for the largest ships are put to their utmost tension of many tons. On the whole, it was considered that the trial was very successful.

SCARBOROUGH AND YORK RAILWAY.

There can be no doubt that at some period, and not a very remote one, railway communications will be formed between all the important towns in England. Scarbro', the Brighton of the north, possesses every advantage that can be desired in a place of summer resort; and the projected line will confer an inestimable benefit on the inhabitants of the great inland manufacturing towns of Yorkshire. We learn from the *Leed's Intelligencer*, that "this great public undertaking, which has been several years before the public, will shortly be commenced, and carried forward with that energy and spirit which are necessary to insure its success. During the last week, Sir John Rennie (to whom a survey was entrusted in 1834,

by the corporation of Scarbro'), Mr. Fulton (the acting engineer), and Mr. Charles Fowler (the principal surveyor), attended a meeting of the promoters of the railway at Scarbro' and York; similar meetings are intended to be held at Leeds, a highly-respectable committee has been formed, solicitors and bankers have been appointed, a large portion of the proposed capital will be subscribed, and arrangements are nearly completed preparatory to applying for an Act of Parliament in the ensuing session. At York, the line will be connected with the west and south by the York and North Midland, the North Midland, the Leeds and Selby, the Derby and Birmingham, the Leeds and Manchester, and the Manchester and Liverpool, the Midland Counties, and the London and Birmingham Railways; with the east by the Hull and Selby; and with the north by the Great North of England Railway, which will be opened as far as Darlington next month. By a junction with the Whitby and Pickering Railway, it will connect itself with an extensive commercial, shipping, and agricultural district; and, by so doing, will, no doubt, materially increase its own prosperity, while it will enlarge the traffic at present conveyed on that line. The distance of the proposed railway from York to Scarbro' will be thirty-eight miles, being nearly three miles shorter than the turnpike-road. The public advantages which will arise from the formation of this railway are considerable. In 1824, it was calculated that 20,000 persons visited that fashionable summer resort, Scarbro'. Since the opening of the railways from the manufacturing districts to York, it has been estimated that 30,000 annually visit that town; and there can be no doubt, that were a railway formed from York to Scarbro', there would be a corresponding increase of visiters of upwards of 100,000.

The whole journey from London to Scarbro' will be performed in twelve hours; and, probably, at some future period, in a still shorter space of time."

REVIEWS.

The London and Birmingham Railway Pocket-book; containing accurate Information upon all subjects connected with Travelling on that Road, and Views of the most Remarkable Places on the Line and its Vicinity. By R. Brooks.

The descriptive part of this little volume was originally written for the "Mechanic and Chemist;" it is, therefore, needless to expatiate largely upon it, but we can assure our readers that it contains accurate information upon the different subjects on which it treats. We must leave it to them to decide how far the writer has succeeded in rendering it amusing by the introduction of a variety of anecdotes, &c. It contains copious tables of the distances, fares, &c., from every station to every other station on the line. It is also embellished with numerous engravings; and as it has been favourably noticed by some of our respected contemporaries, we are encouraged to recommend it to the favourable notice and patronage of the public.

Plain Rules for the Preservation of Health, Hearing, and Sight. By John Harrison Curtis, Esq.; abridged from his Works on the Ear, Eye, &c. Printed on Cards. London, 1840. Darton and Clark.

There is now a growing opinion among those best informed on the subject of education, that the elements of the science of health should form a part of school instruction; not only as being a most interesting and instructive branch of knowledge, but also as being of great practical utility: for when we consider that the constitution of the young is as yet unfixed, and, therefore, peculiarly susceptible to morbific influences, the consequences of which may, perhaps, be permanent; it will at once be admitted, that ignorance of the principal laws of health on the part of the young, is likely to expose them to many evils which might be avoided, were they aware of the tendency of not a few of their practices. On this account we rejoice in the appearance of these cards, which present the fundamental truths of the science of health in a more condensed and intelligible form, than we remember to have ever before seen; and in a shape, and at a price, which render them peculiarly adapted for the use of the young, both at school and elsewhere, who should be taught to con them over and commit them to memory, in the same way as they are in the habit of doing with lists of weights and measures, or any other branch of study. The boy, for instance, who is full of spirit and activity, would thus be put upon his guard against over-exertion, to which his temperament is too apt to lead him, and which ruins the constitution of many a promising youth. The child, on the other hand, whose only pleasure is in books and study, may here learn, that those moderate and cheerful exercises, in which his equals in years indulge, and

which to him appear to be so much time wasted, are really as useful and necessary as those more quiet pursuits in which he delights; and that, by neglecting them, he is diminishing his capabilities for mental exertion. Teachers, also, may derive many valuable hints from these brief compendiums, and may hence learn the proper limits to be imposed upon their young charges, both as to study and exercise.

The Cards on Hearing and Sight show that many of the diseases of those important senses result from the thoughtlessness of the young, whose momentary imprudences, occasioned too often by ignorance, frequently lay the foundation of maladies never wholly eradicated. Sitting on damp grass when in a state of profuse perspiration, for instance, is an every-day occurrence among boys; yet this is stated in the Card on Hearing, to be a common cause of deafness. Rubbing the eyes when any foreign body gets into them, is so natural an action, that we need to be strongly impressed with its impropriety, before we can break ourselves of the habit; and, accordingly, it is all but universal among the young. In the Card on Sight, they are expressly warned of the danger of so doing; and an easy remedy for the inconvenience which occasions it, is explained.

We have given these instances at random, to show how useful such publications as these would be, if put into the hands of the young; but we might select many others equally forcible; and we seriously recommend the adoption of them into schools and families. We should mention that, although we have confined our remarks to the utility of these cards to the *young*, they themselves are not so limited in their scope, but contain advice relative to every period of life.

LIST OF NEW PATENTS.

[WE shall, in future, give a list of new patents in each Monthly Part of the "Mechanic;" they will be chronologically arranged, according to the date of sealing, and will, we trust, be found valuable to a vast number of our readers, both as supplying early information, and for reference at future times.]

Frederick Payne Mackelcan, of Birmingham, for certain improved thrashing machinery, a portion of which may be used as a means of transmitting power to other machinery. Sealed October 1, 1840. (Six months.)

Thomas Joyce, of Manchester, ironmonger, for a certain article which forms, or may be used as a handsome knob for parlour and other doors, bell-pulls, and curtain pins; and is also capable of being used for a variety of useful and ornamental purposes in the interior of dwelling-houses and other places. Sealed October 1, 1840. (Six months.)

William Henry Fox Talbot, of Lacock Abbey, Esq., for improvements in producing or obtaining motive power. Sealed October 1, 1840. (Six months.)

William Horsfall, of Manchester, card-maker, for an improvement or improvements in cards for carding cotton, wool, silk, flax, and other fibrous substances. October 1, 1840. (Six months.)

James Stirling, of Dundee, engineer, and Robert Stirling, of Galsten, Ayrshire, Doctor of Divinity, for certain improvements in air-engines. October 1, 1840. (Six months.)

George Ritchie, of Gracechurch Street, and Edward Bowra, of the same place, manufacturers, for improvements in the manufacture of boas, muffs, cuffs, flounces, and tippets. October 1, 1840. (Six months.)

James Fitt, senior, of Wilmer Gardens, Hoxton Old Town, manufacturer, for a novel construction of machinery for communicating mechanical power. October 7, 1840. (Six months.)

John Davies, of Manchester, civil engineer, for certain improvements in machinery or apparatus for weaving. Communicated by a foreigner residing abroad. Sealed October 7, 1840. (Six months.)

Thomas Spencer, of Liverpool, carver and gilder, and John Wilson, of the same place, lecturer on chemistry, for certain improvements in the process of engraving on metals by means of voltaic electricity. Oct. 7, 1840. (Six months.)

Thomas Wood, the younger, of Wandsworth Road, Clapham, gentleman, for improvements in paving streets, roads, bridges, squares, paths, and such like ways. Sealed October 7, 1840. (Six months.)

Charles Payne, of South Lambeth, gentleman, for improvements in salting animal matters. Sealed October 13, 1840. (Six months.)

Robert Pettit, of Woodhouse Place, Stepney Green, gentleman, for improvements in railroads, and in the carriages and wheels employed thereon. Sealed October 15, 1840. (Six months.)

Henry George Francis, Earl of Ducie, Woodchester Park, Gloucester, Richard Clyburn, of Uley, engineer, and Edwin Budding, of Dursley, engineer, for certain improvements in machinery for cutting vegetable and other substances. Sealed October 15, 1840. (Six months.)

William Newton, of Chancery Lane, civil engineer, for certain improvements in engines, to be worked by air or other gases. Sealed October 15, 1840. (Six months.)

Henry Pinkus, of Panton Square, Middlesex, Esq., for an improved method of combining and applying materials applicable to the formation or construction of roads or ways. Sealed October 15, 1840. (Six months.)

Charles Parker, of Darlington, Durham, flax-spinner, for improvements in looms for weaving

linen and other fabrics, to be worked by hand, steam, water, or any other motive power. Sealed October 22, 1840. (Six months.)

Richard Edmunds, of Bunbury, Oxford, gentleman, for certain improvements in machines or apparatus for preparing and drilling land, and for depositing seeds or manure therein. Sealed October 22, 1840. (Six months.)

Thomas Clark, of Wolverhampton, iron-founder, for certain improvements in the construction of locks, latches, and such like fastenings, applicable for securing doors, gates, window shutters, and such like purposes. Communicated by a foreigner residing abroad. Sealed October 22, 1840. (Six months.)

Gabriel Riddle, of Paternoster Row, stationer, and Thomas Piper, of Bishopsgate Street, builder, for a certain improvement or improvements on wheels for carriages, for the term of seven years, being an extension of former letters patent granted to Theodore Jones, of Coleman Street, and by him assigned to the said Gabriel Riddle and Thomas Piper. Sealed October 22, 1840.

MISCELLANEA.

Discovery of a New Light, and Caution to Experimentalists.—The master of the *Breakwater* light-vessel, in the Sound, has discovered a new mode of preparing the common oil now used for lights on board light-vessels, so as to give a light never yet equalled; and should it be adopted by engineers of steam-ships, &c., the advantage to them will be very great. The matter would have remained over till the meeting of the British Association next year, when, most likely, a paper on the subject would have been read, but for an accident; and hence the caution. The master had prepared a bottle of the said on board, with a view to experiments on shore (it would have endangered the ship to have lighted it on board); but the men and boys knew nothing of the secret, and seeing the bottle, thought the contents to be for common use, and brought it to light: whereby they have sadly injured themselves, and declare they cannot see clearly since; and they are now on board the *San Josef* for treatment. The experimental oil, &c., has been submitted to the judgment of some officers, civilians, and others. and the effect has been partially to deprive them of the power of seeing clearly for some time. We should trust that the brave captain of the *San Josef*, whose prerogative it is to know what is done on board light-vessels, and who is himself an eminent public experimentalist, for the good of the Navy, will not suffer the matter to lie "bottled up" for private advantage, but that he will cause it to tend to the good of the service generally, which we believe is an object near his heart, and that he will see justice done to the poor sufferers. We have given the foregoing on the authority of the *West of England Conservative.* There appears to be some exaggeration in this account; but no well-founded opinion can be formed, till the whole process is explained, and its results exhibited.

Electrotype.—The method discovered by M. Jacobi, of procuring, by means of electricity, convex impressions, or impressions in relief, similar to the outline of a given model, continues to be applied in France with success. This process, to which M. Jacobi has given the name of "plastic galvanism," consists in decomposing, by means of an electric current, a solution of sulphate of copper, in which the mould that receives the impression is placed. The moulds may be of metal, of wax, of wood, of plaster, or even of stearine.* When M. Jacobi makes use of a mould that is not metallic, he covers the surface of it with graphite or plumbago. This process has already been turned to considerable advantage in Russia, in those manufactories where articles of luxury or of domestic use are manufactured. It has also been employed by the inventer to reproduce the photogenic image formed in the Daguerreotype. M. Jacobi makes use of one of the metallic plates on which an image has been obtained by the process of M. Daguerre, as a mould in the apparatus where the galvanic reduction of copper is effected. After twenty-four hours' exposure to an electrical current, he has obtained a galvanic tableau, with a distinct impression of the photogenic image. Methods similar to these have been employed by M. Bocquillon, in Paris, to produce very extraordinary metallic moulds from the printed impressions of vignettes, &c.; and the attempts at copper-plate engravings by means of this process, which M. Richoux has just presented to the French Academy, show a degree of neatness and finish that is inferior to nothing of the kind which has been undertaken.—*Inventer's Advocate.*

Experiments on Iron.—The extensive and rapidly-increasing applications of iron to public and private structures of all kinds, in which durability of material is a first requisite, make it highly desirable to possess accurate information respecting the nature of the chemical forces which effect the destruction of this hard and apparently intractable metal. The preservation of iron from oxidation and corrosion, is, indeed, an object of paramount importance in civil engineering. Mr. Mallet, a gentleman peculiarly qualified for such investigations, both from his knowledge as a chemist, and from his opportunities of observation as a practical engineer, is engaged in making an extensive series of experiments in order to determine, first, the action of sea and river water—in different circumstances as to purity and temperature—upon a large number of specimens of both cast and wrought iron of different kinds; secondly, the general conditions of the oxidation of iron, and how this operation is greatly promoted, although modified in its results by sea-water; thirdly, in what manner the tendency to corrosion is affected by the composition, the grain, porosity, and other mechanical properties of the different commercial varieties of iron; fourthly, the influence of minute quantities of other metals, in imparting durability to iron; and, fifthly, the consequences of the galvanic association of different metals with iron—a subject of great interest, from the applications of zinc and other metals to protect iron. These

* The solid part of fat or oil, separated from the elain, or fluid part.

experiments are still in progress, and will, when completed, afford valuable data for the engineer and chemist. P. TRUMAN.

The variation of the sun's influence in the earth, does not extend beyond a certain depth, and augments in some places more than in others. At a colliery at Wigan, the surface temperature was about 50°; fifty yards deep, the temperature was constant, 53°; at 150 yards, temperature constant, 56¾°; and about 1° for sixteen yards, while in France it was 1° in fifteen yards. At twenty-six feet, it may be twelve months before the sun's heat reaches that depth.—*Phillips.*
G. DAVIDSON.

INSTITUTIONS.

LECTURES DURING THE WEEK.

London Mechanics' Institution, 29, Southampton Buildings, Chancery Lane. Wednesday, December 2, Quarterly General Meeting. At half-past eight precisely.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, December 3, the New Lecture Room will be opened. At half-past eight.

Franklin Mutual Instruction Society, Half-moon Alley, Lower Whitecross Street.—Monday, November 30, Mr. F. Snell, on Sacred Music. At half-past eight o'clock.

Chemical and Philosophical Society, No. 241, High Street, Shoreditch.—Wednesday, December 2, Mr. R. S. Jeffs, on the Compounds of Hydrogen. At half-past eight precisely.

Pestalozzian Academy, Worship Square.—Tuesday, December 1, Mr. F. Wilby, on Vital Education.

Bermondsey and Rotherhithe Literary and Scientific Institution, 4½, Church Street, Rotherhithe.—Monday, Nov. 30, Discussion. At half-past eight precisely.

Mr. Hadley's Rooms, No. 30, Orchard Street, Portman Square.—Thursday, December 3, Rev. S. Blair (Author of "Conversations on Mind and Matter"), on Memory.

QUERIES.

The process of manufacturing elastic or India-rubber tube? E. WHITEHALL.

By what process can paint be got off stone without injury to it? J. P. T.

The best method of bronzing medals?
A. C. R.

The process of making window glass? T. B.

A good way to stain beech of a mahogany colour? I have seen some dark and some light, so that the difference, without a close inspection, was scarcely discernible. Also how the black picture-frames are done, which resemble polished ebony? I also wish to know how the patent leather is prepared for boot-tops; it appears a kind of varnish, mixed with pigment, suitable as to substance and colour, by which new leather is prepared, and old tops are renovated equal to new? W. C.

How saw-dust can be charred or burnt, in such a way as to be equally as serviceable as powdered charcoal? B. E.

[Burn it in a vessel through which there is no current of air allowed to pass.—ED.]

ANSWERS TO QUERIES.

To Varnish Casts of Plaster of Paris.—Equal parts of curd soap and white wax, about half-an-ounce of each to a quart of water; boil together about three minutes. It should be applied, when cold, by a soft brush. It soon dries, and may be polished by using a soft long-haired hat-brush.
WM. MAJOR.

In answer to "I. E. I." by experience I know, that plaster-of-Paris moulds can be cast from with lead or pewter, by the moulds being perfectly dry; no other preparation is required. J. P. T.

TO CORRESPONDENTS.

Mr. Sproule's *steam-boiler will appear in our next.*

J. J. P.—*The process of silvering glass for mirrors, has already been fully described in the "Mechanic."*

Alpha (and some others) *wish to know, the best material used for tooth-powder. We believe there is nothing better than finely-powdered charcoal.*

X. *We cannot recommend a better plan for the formation of a scientific institution, than that adopted by the Bermondsey and Rotherhithe Institution —1st. The formation of a library of reference and circulation. 2ndly. Lectures on the various branches of science, literature, and mechanics. 3rdly. The reading of original or other essays by the members on any subject most congenial to their pursuits (except on religion or party politics). 4thly. All essays read before the Institution, are open to a free discussion, much benefit accruing to the members by an interchange of thought and sentiment.*

C. Davidson.—*We shall be glad to see the paper he mentions. We thank him for the communications we have received, and shall avail ourselves of them.*

A. C. P.—*The Bude light is produced by passing a stream of oxygen through a common argand burner.*

Hope.—*His question was answered some time ago; the 5 at the 11th place of decimals (page 296, Vol. IV.), must be expunged. It is a mistake of the printer's. Vince's "Elements of Astronomy" is as good a book as any upon that subject; but it is necessary to be conversant with the algebraical mode of calculation, in order to understand the reasoning by which the demonstrations are established. This applies to all works that enter deeply into the subject.*

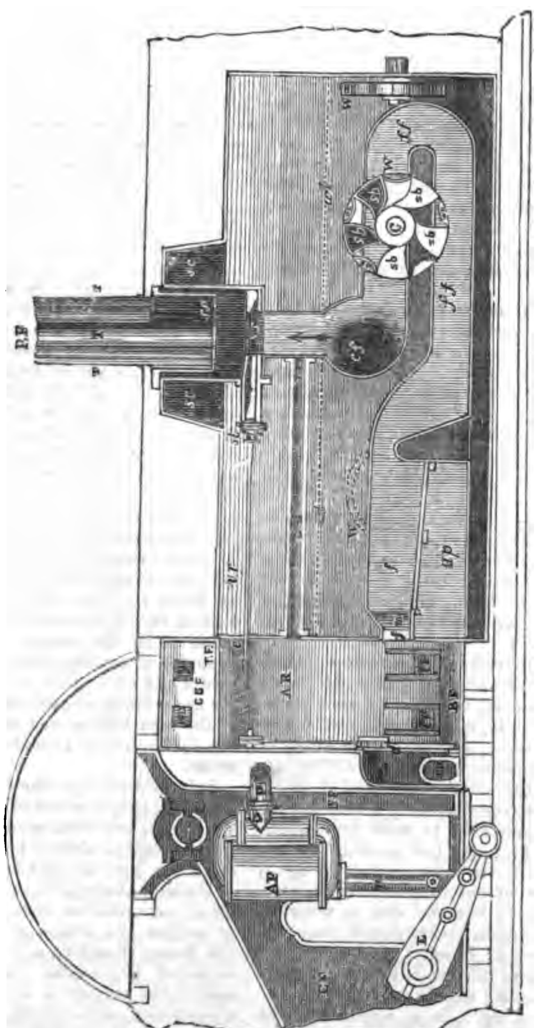
London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by DOUDNEY & SCRYMGOUR (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 122, NEW SERIES. | SATURDAY, DEC. 5, 1840. PRICE ONE PENNY. | No. 243, OLD SERIES.



SPROULE'S STEAM-BOILER.

Fig. 1.

City Press, 1, Long Lane: Doudney and Scrymgeour.

SPROULE'S STEAM-BOILER.

(See Engraving, front page.)

To the Editor of the Mechanic and Chemist.

SIR,—I beg leave to lay before you a plan of a steam-boiler; the object of which is, to prevent explosion of boiler—so far as bare flues are concerned—to consume its own smoke, and to dispense with the funnel of the boiler when at sea.

The first of the three objects has hitherto been contemplated and desired with almost the same success in every level of society. Plans from all classes and characters have in close succession been before the public, and have as rapidly vanished before the breath of the judicious in mechanics. My plan, among the rest, has struggled long for life, and has been a thing about which the scientific seem at last to respect as nothing. Whether this should be its deservings, you will gather from itself; premising, first, a few remarks connected with causes of explosion.

The causes of steam-boiler explosion may be considered two in number—namely, excessive pressure of steam, resulting from overloading the safety-valve; and stoppages, or want of a proper supply of water, whereby the flues of the boiler are weakened by the action of the furnaces, and the steam excessively heated. Hall's condensers, as a remedy for the latter evil, would be complete, if pumps could be wrought without valves, and the vessel be made to obey the same trim in all circumstances; but where there is the smallest chance of the water being delayed to the boiler, or the flues being uncovered, I say, it is the faith of the prudent ever to be on the alert.

The end, therefore, I have ever had in view, since I began to interest myself in this important matter, has been to plan something that would, at all times, and under all circumstances, operate to the safety of the boiler, independent of the care or attention of any individual; and I think this can be accomplished by a very simple apparatus applicable to most steam-boilers, of both high and low pressure.

The construction I have given in fig. 1, at w and w of this instrument, is variable, of course; but the end to which it acts, is the certain prevention of the steam ever acquiring an atom of heat among its particles, more than should be in thermometrical quantity with its density.

w and w of fig. 1, is a wheel made as large as possible for the boiler, which revolves by the one side of it being always buoyed round and round by the steam, which enters into the steam-buckets, *s b*, *s b*, *s b*, &c., on one side only; while the same steam-buckets on the other side of the wheel are filled with water, in which the wheel is seen at present to be totally immersed, *w b*, *w b*, being the proper level of the water in the boiler.

As the wheel revolves, it carries round on its circumference a number of smaller buckets, *w b*, *w b*, *w b*, which, owing to their make, in respect to the larger buckets, or the way the wheel revolves, are continually filled with water. In the bottom of the smaller buckets, *w b*, *w b*, &c., there are holes, through which the water they lift would flow in streams, if the top of the wheel was not below the level of the water in the boiler.

Now suppose the water in the boiler is getting low, or before the boat has yet left her moorings, let the water be too low in the boiler, the steam generating, and the wheel, w, will be revolving in the boiler, as I have explained; but the top of the wheel, w, will now be above the water, and, consequently, the water is carried up in the buckets, *w b*, *w b*, *w b*, above the water in the boiler, or above the bare flues; therefore the water will fall from the height to which it is lifted, through the holes in the bottom of buckets, down through the steam, absorbing every excessive atom of heat that may pass into the steam from the bare flues of the boiler; for it is evident, that if the water of the boiler is lifted above its unabsorbing level into the steam, incessantly heating above its proper degree of thermometrical heat, and so above the temperature of the water below the flues, that it will ever maintain an equilibrium of heat and just temperature in the steam, by its absorbing from the steam the heat above the temperature of itself, which, of course, will go to the generating of new steam; the same as if the heat had passed from the flues of the boiler direct into the falling drops of water.

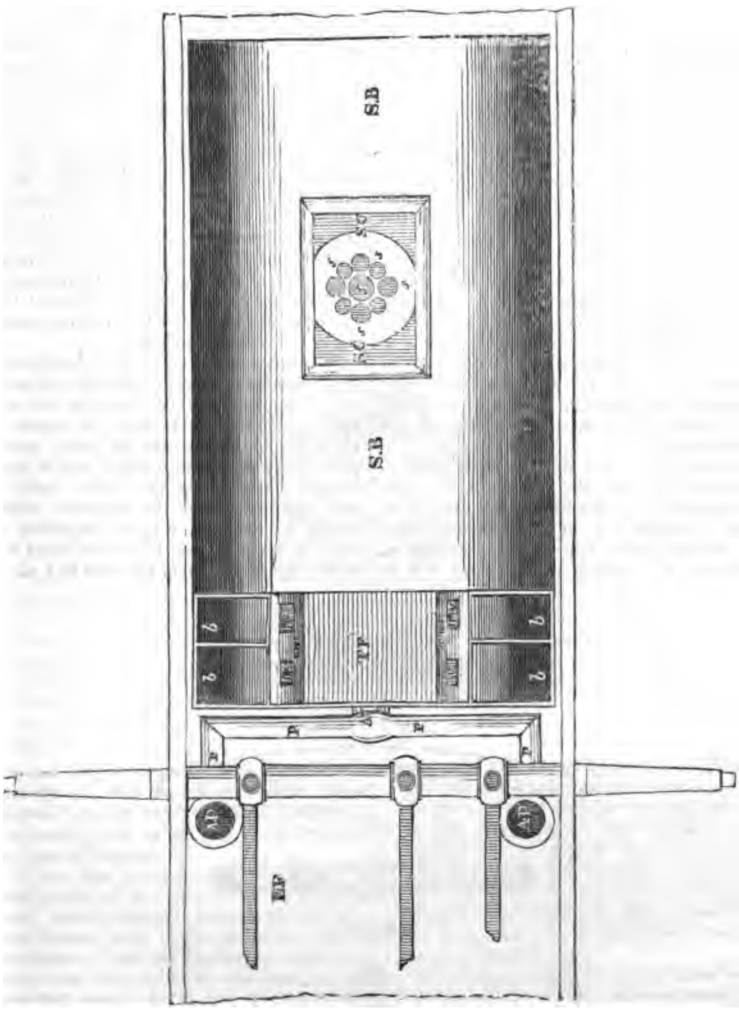
It is evident that the flues of the boiler (granting they are free of crust) will never arrive to a heat that would in the smallest degree weaken them; for it is only when the steam gets dry and hot, that the flues of the boiler become dangerously red, there being not sufficient moisture in the steam to weaken the action of the furnaces on the flues; therefore a collapse of flue is rendered impossible, while an insurmountable barrier is ever opposed to decomposition, or anything of that sort.

This wheel could be greatly increased in power or useful effect, by having a pair in the boiler, with a soft spongy band pass-

ing over the two; as this band would absorb much water, which would be delivered to the action of the heat along the stretch between the two wheels.

As much water lifted per minute as the quantity of feed per minute, is sufficient, if properly distributed among the steam, to insure the greatest amount of safety

FIG. 2.



from this quarter of danger in steam-boilers. As for safety-valves, the common valve is the best, if not abused; and no improvement can be made on it, except by closing it in from the reach of the ignorant.

The funnel of the steam-boiler of a sea-going vessel can, I think, be easily dispensed with at sea, by an arrangement of boiler and machinery shown in figs. 1, 2, 3, and 4, which I will state the argument of, before entering on the description.

Air which is drawn through the fuel of the furnaces, by the draught of the funnel

to occasion combustion, is, in this boiler, forced through the furnace to promote combustion, which consumes the smoke and dispenses with the funnel at the same time, by the air being compressed till it be in proper ratio with the hydrogen or smoke of the fuel or denser, that the whole, after passing through the furnaces and flues of the boiler, may force out into the sea beneath its surface.

In figs. 1 and 2, A P is a double-acting air-pump, which is seen placed well out of the way on the outside framing of the engines. These pumps receive motion from the side-beams of the engines by the piston-rod, *r*, being connected in the usual way; L represents the side-beam.

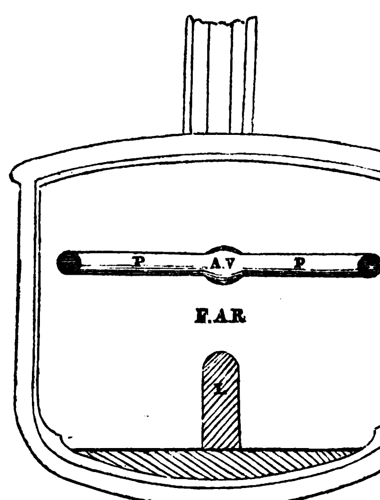
Across the front of the boiler enclosing the coal-boxes, C B, C B, in fig. 4, is a face of iron, forming between the boiler and itself and the two coal-boxes, a receiver for the air forced into it by the pumps, A P. F A R, in fig. 3, represents the outside of this air-receiver; fig. 4 shows the outside removed, representing the interior of the coal-boxes, C B, C B, and the front of the steam-boiler.

In fig. 2, P P, P P, are the pipes conveying the air from the pumps, A P, to the receiver, the top of which is the floor, T F. The air-pipes, P P, in fig. 3, show where the air enters the front of the receiver at the vent, A V, which is the same A V of fig. 2. In figs. 1 and 2, C B F is the coal-box top, into which the coals are thrown by the coal-trimmers standing on the top of the air-receiver; T F, T F, in figs. 2 and 3, show the same floor.

When the coals are being taken out of the partition, *c* or *b*, in fig. 2, by the stokers below in the air-receiver, at either of the ports, *l v*, *l v*, *h v* or *v* is shut on the top ports of the same partition of the coal-boxes; *v* of *h v* is a valve seen half removed from the port, while *v*, the same kind of valve, is covering the port of the other partition. The coals would be removing, in the meantime, from the partition that has the top port shut, while the other partition would be refilling with coals. Similar valves are fitted to the bottom ports of the partitions, which are not shown; they must close on the port from the outside, while the top valves close on the port from the inside.

It is easy to perceive, that the object of this valve-geer is to prevent the air escaping from the receiver through the coal-boxes. This object, and all concerned about the boilers, could be easily accomplished, by enclosing the fuel in one grand receiver, and firing the boiler from the end farthest from the engines; and it would be the best way if the vessel was built of iron, or the ship to be lined with boiler-plates, to form the coal and air receiver; for it must be perfectly air-tight, and built in the manner of a boiler.

FIG. 3.



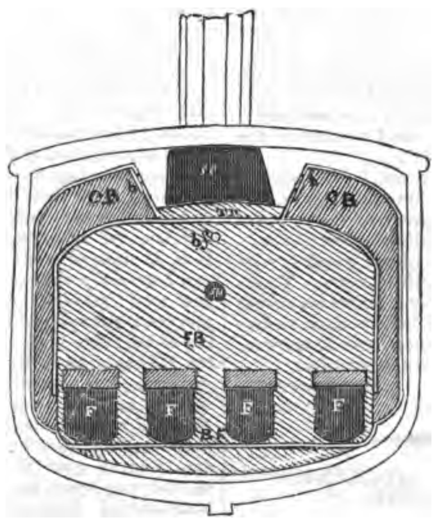
In figs. 3 and 1, L is the entrance by which the stokers go in and out of the receiver. It is constructed on the same principle as a canal lock, and holds one or

two men; L D is the door from the ship into the lock, and *d* is another door rising upwards, and opening the lock to the air-receiver. The use of the lock is to get rid of the ashes of the furnaces, as well as for the entrance to the boilers.

In fig. 1, *f m* is the furnace mouth; *f*, the furnace; *a p*, the ash-pit; *f f*, *f f*, are the flues of the boiler, joining at *c f*, in the usual manner, up in the direction of the arrows from the joining of the flues; the flues terminate at the top of the steam-chest, S C, S C; S C, of figs. 2 and 3, is the same chest; and S B, S B, in fig. 2, is the top of the boiler.

Suppose now, that the ship is preparing for sea, before the furnaces are kindled, there is placed on the top of the flues where the funnel stands, a portable funnel, P T, composed of the single pipes or iron tubes, T T, &c., each being as light as one or two men may put up with ease by hand; *s s*, *s s*, &c., in fig. 2, show the steps of each of these tubes of fig. 1. A little below the steps of the tubes in fig. 1, is a valve, which is shown drawn back from its seat, *v s*; *v r* is the valve rod, passing through the stuffing-box, *s b*, in the boiler; through the end of the boiler the rod is seen to pass to the hand of the engineer; the rod is for opening and shutting the passage of the flues from their forced course, S P, or their natural course, up the funnel, P F, by moving the valve, *v*, in and out of its seat, *v s*.

FIG. 4.



When the furnaces are kindling, the vent valve, *v*, is drawn to where it is now seen; and a sufficient draught by the portable flunnel will, in the meantime, get up the steam. Let the engines be set in motion, and the ship be got clear of the crowded river, &c.; the air-pumps are thrown in geer with the engines, and the air is discharged into the receiver.

Let the doors of the coal-boxes, *v v*, &c., and the doors of the lock, or one, at least, be closed; the air that the pumps are throwing into the receiver will pass through the furnaces up the portable funnel; but let the valve, *v*, below the steps of the tubes, be slowly pushed into its seat, V S, then will the air in the receiver be slowly becoming denser, until it balance the weight of water outside the ship, where it is now discharged. The contents of the furnace being stopped by the valve, *v*, from passing up the funnel, P F, the tubes, T T T, &c., that compose it, are now unshipped from the boiler, and placed out of the way, leaving a clear deck and unclouded atmosphere.

S P is the passage from the flues to the outside of the boiler, where it may be afterwards taken through the ship, as it is seen convenient; though, if the ship is not over deep for the purpose, through the bottom of the ship the smoke-pipe should pass.

At all times the pressure of the air in the receiver, and, consequently, in the flues of the boiler, should be more than the weight of the water that has to be

overcome for the discharge of the contents of the furnaces; and this can be done by placing a valve on the discharge pipe, S P, so as to open to the current from the furnaces towards the vent end, having it properly loaded, to give the density in receiver desired. The vent passage, it will be seen, will not require to be the same size as the funnel, by a great deal; a small passage, of about a twentieth in area of the funnel usually employed, will be quite sufficient to carry off the fumes of the furnaces, &c.

That the smoke of the furnaces will be consumed to the atom, I think is self-evident, nor will be doubted by any one acquainted with the subject. Likewise, I think, no annoyance will be felt from the fumes rising from the water up around the ship, as, when it emits from the surface of the sea, it will instantly unite with the oxygen of the atmosphere and form the heaviest of our gases; consequently, it will remain on the dead surface of the sea, &c.

Sir, perhaps it may not be uninteresting to you to know, that these plans, but especially the first, have gone the round of a thousand mechanical and scientific men for four years past, without meeting with a single argument against them. Trusting, now, however, for a judicious sifting of their worth, if you bestow them a place in your Magazine, I beg leave to remain,

Sir, yours most respectfully,

M. SPROULE.
Engineer.

IRONBRIDGE MECHANICS' INSTITUTE.

ON Wednesday evening, November 25th, the Provisional Committee called a general meeting of those persons who had enrolled their names as members of the Institution, which was held in the Infant School-room, Ironbridge; the meeting was large and well attended. Alfred Darby, Esq., of Coalbrook Dale, having taken the chair, the rules for the government of the Institution were read and passed; they then proceeded to elect a Board of Directors, consisting of President, four Vice Presidents, and thirty Committee-men (fifteen of whom are operatives), into whose hands the sole management of the Institution is vested. A vote of thanks was next returned to the Provisional Committee, and to their acting secretary, Mr. Walker. The chair being vacated, a vote of thanks was returned to the worthy chairman for the able and efficient manner in which he had conducted the meeting. The chairman returned his thanks, and expressed his gratification at seeing so large an assembly, assuring the meeting that they should always have a continuation of his support in any way that would be serviceable to the Institution. Abraham Darby, Esq., next rose, and having entered fully into his brother's sentiments in the most noble and generous manner, encouraged the members to proceed; for he felt fully persuaded, that not only the working man, but the rich, would be benefitted by a union of the talent which would be brought into requisition by this Institute. After a few more short speeches by Messrs. Edwards, Bayliss, &c., the meeting concluded with marks of the warmest approbation.

I stated in my last note, the favourable circumstances with which we were surrounded; indeed, I think the starting of this Institute is without a precedent. Before its commencement, about 300 persons have enrolled their names. Gentlemen are stepping forward in every direction who offer their help and assistance, and working men generally are ready to embrace the advantages offered to them. It is a pleasing scene to see the good-will and fellowship that reign between master and man; all distance is banished; employers and employed are both endeavouring to facilitate business, and to establish the Institute on a firm and sure footing. An example is here offered, which, I trust, will be followed in every place where a Mechanics' Institute is not formed; and may working men in parts of the kingdom find as good friends and supporters in their employers, as they do in the neighbourhood of Ironbridge and Coalbrook Dale.

J. C.

Coalbrook Dale, Shropshire.

Meteors.—On the 26th of August, 1839, a splendid meteor was seen towards the shores of Albania, near Kontzolara. It is said to have left behind it a broad fiery tract for twenty seconds. On the 9th of November, 1839, at Antigua, a little after day-break, a concussion was felt in the town, preceded by a sound like the heavy discharge of ordnance. On inquiry, it was found that a brilliant meteor had been seen by some servants and labourers. On the 13th of May, 1840, a meteor larger than the full moon, was seen at Albany, Boston, Newhaven, Rhode Island; there was a brilliant train left behind, which retained its brightness some seconds after the main body had become entirely extinct. It exploded with great force.—*Silliman's Journal.*

THE BRITISH NAVY.

Considering our present position as it respects the probability of war, it may not be uninteresting to our readers to know what was the result of the efforts made by our gallant seamen during the unprecedented war, which ended in the year 1815.

General Statement of Ships Captured from Hostile Powers and Destroyed in Action during the War, from 1793 to 1801, and 1803 to 1815.

	Ships of the Line, including Fifty-fours.		Fifties.		Frigates.		Sloops and Small Vessels.		Total.	
	Ships.	Guns.	Sh.	Guns.	Ships.	Guns.	Ships.	Guns.	Ships.	Guns.
French	80	6264	7	354	217	7382	408	3997	712	17,997
Dutch	29	1794	—	—	40	1336	103	775	172	3,905
Spanish	24	1984	—	—	30	1068	142	941	196	3,993
Danish	24	1774	—	—	24	848	37	475	85	3,067
Russian	1	74	—	—	2	74	1	14	4	162
Turkish	1	64	—	—	7	270	7	96	15	430
American	—	—	—	—	3	139	14	176	17	315
Total	159	11,954	7	354	323	11,117	712	6474	1201	29,869
British	5	370	2	100	27	856	132	1891	166	3,017
Difference	154	11,554	5	254	296	10,261	580	4783	1035	26,852
Enemies' Ships lost by accident	11	—	—	—	14	—	Many	—	—	—
British ditto	32	—	7	—	86	—	230	—	355	—

Officers who lost their Lives during War while in Command of Vessels, to 1809.

	Killed.	Blown up.	Drowned.
Post Captains	22	4	26
Commanders	10	1	35
Lieutenant Commanders	16	0	23
Vice Admiral	1 (Nelson)	0	0
Rear Admiral	0	0	1 (Troubridge)

British Navy, July, 1815.

	Ships of Line.	Frigates.	Sloops, &c.	Brig and Small Vessels.
At sea	34	86	76	131
In Port and Fitting	31	61	51	52
Guard Ships	4	4	4	10
Hospital and Prison Ships	2	0	1	0
In Commission	71	151	132	193
Ordinary and Repairing	118	77	37	36
Building	17	9	4	1
Grand Total	206	237	173	230

But we would caution our readers against too confidently calculating, that such must of necessity be the invariable success of our navy. Many reasons might be given for such a caution; and without wishing to put forth our religious opinions, we cannot avoid observing, that these things are in the hands of the Great Disposer of all events; and that he does not always award the victory to the strong, we, as a nation, have good reason to know. But, to return to the visible means of success, in which it behoves us to be prudent, we cannot but think that, as a maritime nation, we have not been sufficiently attentive to this right arm of our strength.

We have, by various means that we could name—had we space, and were such discussions adapted to this work—degraded the character of our seamen, so that the defenders of our country hold not the same position which they once did, and which they have well merited. The result has been, that few parents will send their children to sea who can avoid it, therefore we want those prime seamen who respected themselves and were respected; and who, at the commencement of the war already alluded to, produced, by their success—at first well disputed by the enemy—that moral effect which contributed to the brilliant success that attended our navy. This may be denied by some, but we defy them to prove that it is not correct.

Much as we are gratified by our success at St. Jean D'Acre, we do not think it at all militates against the opinions we have advanced. We are perfectly aware that great attention has been paid to the art of gunnery, but this does not prove that seamen have not been neglected; and it must be admitted, that this action has not been of a nature to show what would have been the result of a contest between two hostile fleets.

We have, perhaps, for a mechanical work, travelled a little out of our way in this article, but we would ask our readers whether a ship is not one of the most noble pieces of mechanism? The vast quantity of material, and the great expense of labour in constructing one of our first rates, we gave an account of in No. 108, N. S. From the contemplation of such a structure, we are necessarily led to the consideration of the great advantage that has resulted to this nation from them, and then to the hearts of oak that manned them, and the neglect with which this class of our fellow-countrymen have been treated; and, we trust, that our readers will excuse our having occupied some of our pages in this way, in consideration of the importance of the subject. We may, perhaps, return to this subject, and treat it more mechanically.

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, December 10, Cowden Clarke, Esq., on Milton. At half-past eight.

Chemical and Philosophical Society, No. 241, High Street, Shoreditch.—Wednesday, December 9, Mr. Gaze on Hydrostatics and Hydraulics. At half-past eight precisely.

Pestalozzian Academy, Worship Square.—Tuesday, December 8, Mr. Thomas, on Sulphur.

Bermondsey and Rotherhithe Literary and Scientific Institution, 4½, Church Street, Rotherhithe.—Monday, Dec. 10, Mr. Walter Hume, on the Life, Genius, and Writings of Cowper. At half-past eight precisely.

Mr. Hadley's Rooms, No. 30, Orchard Street, Portman Square.—Thursday, December 10, Rev. S. Blair (Author of "Conversations on Mind and Matter"), on Memory.

QUERIES.

Diameter of cylinder, length of stroke, and thickness of metal (brass) for cylinder of engine of one-horse power, high pressure? Also, length, breadth, height, and thickness of metal (iron) for boiler for ditto? A. B.

The best method of making the best lamp-black? Also how to make the best vegetable-black? Also the simplest method of making a lithographic press? A.

To make artificial human eyes? To paint mahogany colour in oil? To imitate zebra wood in paint? To stain wood black? To stain violins a dark colour? To prevent lead from oxidizing? C. S.

The best process of colouring wax candles in red, pink, blue, green, and yellow?
A. M.

I have tried in vain to inflame gunpowder with my electrical battery, which consists of nine two-pint jars. I have enclosed the powder in cases, made of paper and wood; I have even confined it in glass tubes; but the charge appears to pass through it as freely as through a good conductor. If any of your enlightened correspondents can inform me of another method, or the probable cause of my failure, they will greatly oblige
A. Y. E.

TO CORRESPONDENTS.

J. Child.—*Marble is polished with an oxide of tin, called putty-powder.*

G. Mitchell.—*The arteries are divided into ramifications, which extend to the brain and all parts of the body. The brain receives about one-tenth part of the whole mass of blood. (See "Mechanic," No. 76, N. S.) "Hooper's Anatomist's Vade Mecum" is the best work we can recommend him to read.*

J. B.—*The atmospheric engine, exhibited last summer, on Wormwood Scrubbs, was described in the "Mechanic," (No. 13, N. S.) in March,* 1839.

J. N.—*The announcement of lectures came too late for insertion.*

A. Z. *will find a letter addressed to him at the "Mechanic" Office.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by DOUDNEY & SCRYMGOUR (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

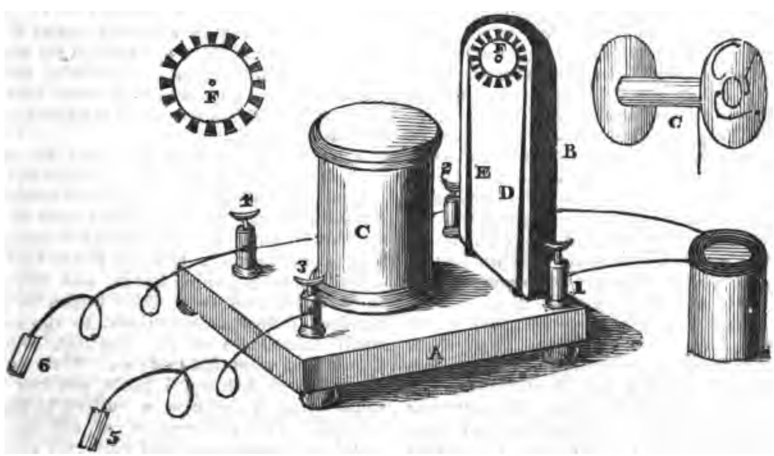
THE

MECHANIC AND CHEMIST.

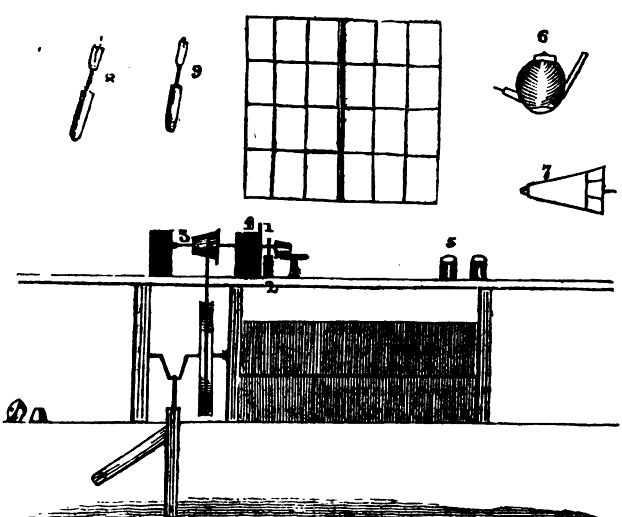
A MAGAZINE OF THE ARTS AND SCIENCES.

Nos. 123 & 124, NEW SERIES. | SATURDAY, DEC. 12, 1840. (PRICE TWOPENCE.) | Nos. 244 & 245, OLD SERIES.

ELECTRO-MAGNETIC MACHINE.



POT-MANUFACTORY.



 City Press, 1, Long Lane: Doudney and Scrymgour.

ELECTRO-MAGNETIC MACHINE.

(See Engraving, front page.)

A, fig. 1, is a mahogany stand; B, an upright piece, morticed into the bottom; C, the reel or bobbin, on which is wound 300 feet of copper wire, one-twelfth of an inch in thickness, and covered with silk or any resinous substance. The plan I always adopt is, to wind round narrow silk riband in a spiral form, or lay the wire on the riband and turn it over, when it may be tacked along with a needle and thread. I have found this plan much better than the common method of covering, as it will sit much closer together, which is of great importance: this is the primary coil. When the primary coil is finished, you wind round 3000 feet of very fine covered copper wire, one-ninetieth of an inch chain. The best way is, to have this covered by a machine in the usual way, or get it at the philosophical instrument-makers ready covered; where you will get it in separate lengths of about thirty-six yards each, which should be untwisted, and soldered together at every parting. We will now describe the coil, C. In the first place, get a piece of good sound beech, about seven inches long, three inches in diameter; bore a hole through it. one inch and a half in diameter, and turn an arbor to fit it on; then turn the piece down as thin as possible, and fit on the mahogany ends to it. The round ends should be about four inches and a half in diameter, and glued firmly to the central tube, leaving five inches clear, after turning it true; and (French polishing it, if you choose) while yet in the lathe, you wind on 300 feet of stout wire, first passing the end of it through the mahogany, leaving out four or five inches; wind it as close as possible, and as near as you can at right angles to the axis. Having wound all your large wire, bring the end out the same side as you entered; then solder the end of the fine wire to the last round of the stout or primary wire, and wind it the same way as the first: this is termed the secondary coil. Having finished winding it, bring the end out the same way as the others; pull out the centre or arbor, and fit it down on the stand, A, passing the three wires through the bottom, and soldering one end of the stout wire to the binding screw, No. 1, and the other end to the brass spring, E; then connect the brass spring, D, with the screw, No. 2, taking care the wires do not touch one another in crossing; then connect the ends of the fine wire by soldering, with the screws, Nos. 3 and 4. F is a brass wheel for breaking connexion; it is about two inches in diameter, with sixteen dovetail notches cut in, and filled up with bits of box or any other hard wood; the axis passes through the upright, B, and turns with a little wink behind. The brass springs, D and E, gently press on the wheel; one of them behind in constant contact, the other comes up with a fine steel point on the rim, when, by turning the wink, the point passes from the brass to the wood, when a shock is given. You may give sixty or a hundred shocks in a second; but about one turn, or sixteen shocks in a second would be strongest: 5 and 6 are the handles for the shocks. In the centre of the helix, you put a bundle of covered iron wire—such as bonnet-makers use—when the shock is increased tenfold.

I have a machine of the same size as the above, which, with a small pot battery of half-a-pint, will completely fasten a person to the handles, in the most excruciating pain, till the handle is stopt with a pint battery. It would fasten half-a-dozen persons joining hands, and make them dance and twist their bodies in a hundred different contortions, to the no small amusement of the operator, who should stop when bid to do so. With not a very large battery, I doubt not but I could bring a horse or a bullock to the ground. The deflagration of different metals and decomposition of water, are very beautiful. S. CHICK.

A VISIT TO A POT MANUFACTORY.

No. III.

IN our last we proceeded with the formation of the utensils by the thrower; we will now notice the operations of the person who smooths and polishes them—the turner.

The machine at which the turner works, is called a lathe, and resembles, in some respects, the lathe of the wood-turner. Fig. 4 is a representation of the turning-lathe of the potter. The spindle has a screw thread at one end, upon which is screwed a chuck, or, as it is called by the workmen, a chock of wood, tapering in form from the end in which the nut is inserted. The turner is provided with a large number of chucks of different diameters and shapes, in order to fit the various sorts of ware to be turned. The tools used by him are made of iron, and are of various sizes, from a quarter of an inch to an inch and a half in breadth, and

six inches in length; the cutting end is turned up about half-an-inch, and filed to a good edge.

The article to be turned is placed upon the chuck, and the lathe being put in motion by a woman called the lathe-treader, the turner fixes it fast thereto, by pressing a small portion of the top of the article close to the chuck. The turner now proceeds to cut away the superfluous parts, and to bring the vessel to the required shape; after this is done, the motion of the lathe is reversed, and a smooth flat tool being applied with a gentle pressure, the vessel is made quite smooth, and its solidity improved. A small tool is now applied to the top of the article to make it round; it is then removed from the chuck and placed upon a board. This is the way in which a cup, a bowl, or a mug is turned. But there are some articles that pass through the turner's hands several times; tea-pots, for instance, are operated upon four distinct times by the turner. First, they are cut and smoothed, on the outside; next, they are natched; that is, a ridge is made on the inside of the rim for the cover to rest upon; the covers are then turned and placed upon the tea-pots; lastly, when they are become hard, the covers are let down so as to fit the tea-pots exactly. Mustard-pots, sugar-boxes, natched butter-tubs, &c., undergo nearly the same operations.

Some articles of pottery are fluted or checquered; cream-coloured ware and black tea-pots are generally fluted. This effect is produced in what is called an engine lathe, which, in addition to a rotary, gives an horizontal motion to and fro to the article, whereby the turner is enabled to make the requisite incisions at regular intervals. The mechanism of the engine lathe will be understood by a reference to fig. 5. The lathe is turned round by the hand during the process of fluting, and the cog-wheel, moving in connexion with the nickled pulley, enables the workman to make the flutes in the proper required intervals.

The edges of cups and basins are sometimes scolloped; this is done in the following way:—After the vessel to be scolloped has been smoothed and polished, an instrument, called a scolloper—a circular piece of tin moving on an axis, its edge being bent in and out to correspond with the sort of scollop required—is applied to the top of the vessel, with a pressure sufficient to force it through the pot to the chuck; the lathe is then pulled gently round by the lathe-treader. By this means the whole of the edge of the article is scolloped; it is then removed, and a tool being passed over the scollops to make them smooth and round, the article is finished, by passing a wet sponge several times over the scolloped part, to remove any bits of clay that may have adhered to it during the process of scolloping.

A row of beads or other figures is sometimes made round the pots by an instrument resembling a scolloper, called a runner.

An earthenware turner, a turner of lustre and black, a chinaware turner, and a turner of common-coloured ware, are four distinct branches of the turning art. We have just described the operations of an earthenware turner.

The coloured-ware turner is so called, from the making of different figures with various colours upon the pots, before he removes them from the chuck. The articles that are coloured this way are generally basins, jugs, and mugs. The process is as follows:—The article is placed upon the chuck, and turned to the required form; it is then rounded at the top, and left on the chuck. The turner has at hand a number of vessels, each containing a different colour or slip. These vessels have a sort of spout on each side; the cover is fastened on with clay, and made air-tight. Into one spout is inserted a quill, and fastened with a bit of clay; the end of the quill is allowed to protrude a little way. The lathe is turned round slowly, and the turner applying the spout, into which the quill is inserted, to the pot, blows gently down the other spout, thereby forcing the slip out of the vessel upon the article to be coloured. Bands of various breadths are made round the article with different-coloured slips. The middle band is generally the broadest; upon this band the turner pours from a flat vessel—the interior of which is divided into three compartments, each containing a different coloured slip—another band made of a zigzag kind. The article is then removed from the chuck and put to dry.

Coloured ware should always be pretty strong; for the clay, having a great affinity for water, the slip which is put upon it would soon dissolve them, were they not of considerable thickness.

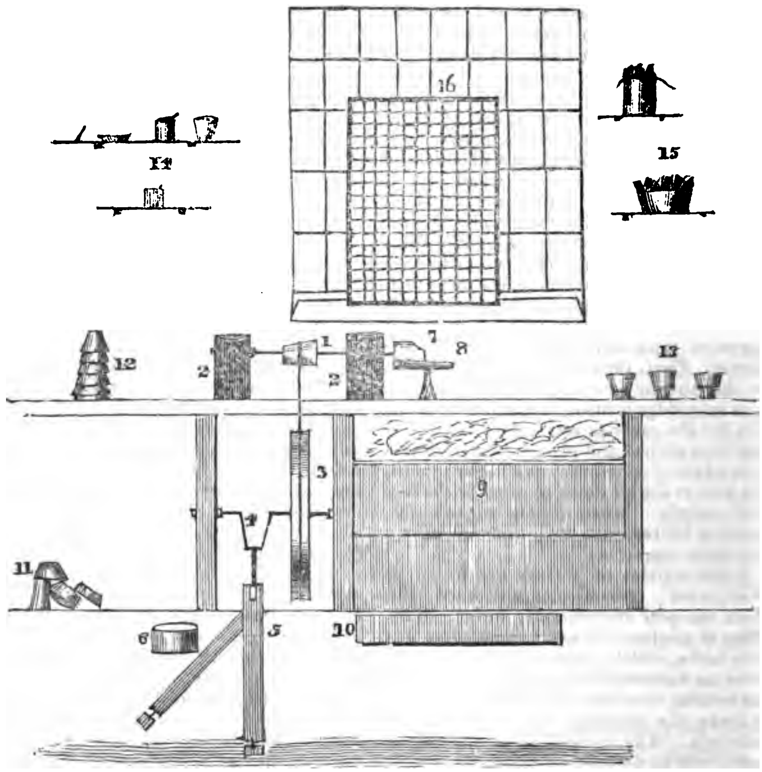
Description of the Engravings.

Fig. 4, a lathe: 1, the spindle; 2 2, uprights, in which the spindle moves; 3, the wheel; 4, the crank; 5, the traddle; 6, a step for the lathe-treader to stand upon; 7, the chuck; 8, the rest; 9, a box for holding the cuttings which come off the pots, called the shaving-box; 10, a board

for the turner to stand upon; 11, chucks; 12, unturned cups; 13, turned cups; 14, oil-cups, &c.; 15, turner's tools; 16, a guard, to prevent the pots breaking the window when they fly off the chuck.

Fig. 5, an engine lathe: 1, the cog-wheel; 2, a rest, containing the nickled pulley; 3, a circular board—the lathe-treader turns the lathe round with the help of this; 4, an instrument for stopping the horizontal motion of the lathe.

Fig. 6, the vessel with two spouts,



mentioned above; it is called a blowing bottle.

Fig. 7, the vessel used in making the zigzag bands with different-coloured slips: it is called a swagging bottle.

Fig. 8, a scolloper.

Fig. 9, a runner. There are several sorts of runners, known to the workmen by the names of gadaroon runner, bead runner, &c.

SCIENCE WITHOUT MYSTERY.

No. I.

OPTICS AND THE PRESERVATION OF THE SIGHT.

INTRODUCTION.

It is a custom which has become, by convention, a prerogative with all writers who presume to address the public, to commence by a few words in their own behalf; and it happens too often that they have much need of an excuse for their impertinence. It is not enough for one who pretends to teach others, that he be well disposed and mean honestly; he must also possess knowledge and judgment, to enable him successfully to accomplish the task he undertakes. . Some authors affect much diffidence and modesty, complaining of their own incompetence, and regretting that the work had not been undertaken by abler hands; while they cunningly

magnify the difficulties they have had to encounter, and reluctantly confess that their triumph is complete, and that they have surpassed in excellence all their predecessors; but an old gentleman of evil report says, that his favourite sin is "the pride that apes humility." We all strive to obtain the suffrage and approbation of our readers; a legitimate and laudable object, since the desire of praise often assists in rendering us deserving of it. For my own part, I have little glory to expect from the concoction of a work, which, from its nature, must be considered as little more than a compilation; but if I suggest no new theory, and propound no new doctrine, I have the advantage of being secure from the danger of promulgating false opinions, and interfering with subjects that lead to angry controversy. My object is, to explain the principles and phenomena of the most useful and interesting sciences, in simple and popular language, that may be understood by those who are not initiated in the technical forms of the higher branches of science. By "popular language," I do not mean exclusively the language of the uneducated. This treatise is equally adapted to the use of the Royal and other great families, and to the working mechanic, and all those who have not made a previous study of the more elaborate and abstruse writers, who are justly looked upon as the highest authorities. Having thus explained my intentions, I have only to express a hope that my endeavours, though humble, may not be found entirely useless; and, begging the reader's favourable reception, I will now proceed, without farther preface, to explain

THE PRINCIPLES OF OPTICS.

Optics is the name given to that science which describes the various phenomena of light and vision, and the laws which regulate the passage of rays through transparent substances, and their reflection or dispersion when intercepted by impenetrable obstacles.

LIGHT is a material existence, as is clearly proved by its motion and its action upon inanimate matter, as well as upon the organs of vision; but it does not appear to possess the principal properties which characterise ordinary matter. Rays of light concentrated in the focus of a powerful lens, though moving with a velocity almost surpassing human conception, have not been discovered to communicate any impulse to bodies exposed to their action; it is, therefore, concluded, that light has no mechanical inertia. It also appears that light is not subject to the laws of gravity, as all perfect matter is; for it shows no tendency to be drawn from its course, either by the attraction of the earth, or of any other planet. The most incomprehensible of all the phenomena of light, is its passage through compact bodies, as glass, diamonds, &c.; which seems to prove, that it does not even possess extension, or the property of occupying space; though it is difficult to conceive any existence without it. Light is propagated and transmitted through the regions of space in straight lines, and with uniform velocity. Astronomers have discovered, that when the earth is between the sun and Jupiter, the satellites of that planet are eclipsed about eight minutes sooner than they could be according to calculation; and that when the earth is nearly in the opposite point of its orbit, these eclipses happen about eight minutes later than the calculated tables predict them. Hence it is undeniably certain, that the motion of light is not instantaneous, since it takes about sixteen minutes and a half of time to go through a space equal to the diameter of the earth's orbit, which is at least 190,000,000 of miles; consequently, light must travel at the speed of about 190,000 miles in a second of time.

All visible objects are either sources of light—as the sun, the fixed stars, a flame, &c.—or they are illuminated by the rays emitted by some other body, and transmitted, by reflection, to the eye of the spectator; except in the case of imperfectly transparent bodies, which partially intercept and modify the rays, when such bodies are placed between the eye and the light. That we see objects by their reflection of incident rays which strike upon them, may easily be proved and understood, by observing that we cease to see an object the moment the light which shines upon it is removed or intercepted. This privation of light is called shadow; and, it must be remarked, that though we can see an object indistinctly, in an ordinary shadow, we only see it by receiving the rays reflected from some surrounding objects which are not totally obscured or deprived of light; but, in a perfect shadow, all bodies are entirely invisible; hence, it is evident, that the sensation of vision is caused by the action of rays of light upon the organs destined for their reception.

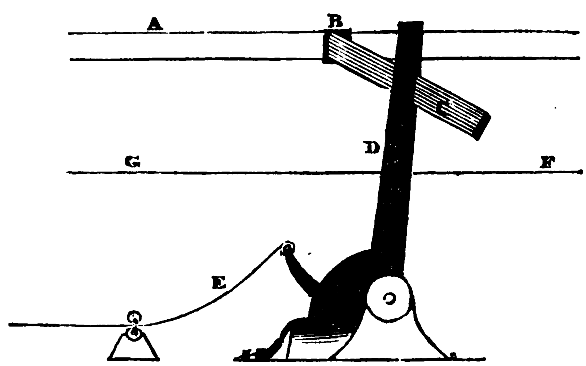
Q. E. D.

(*To be continued.*)

PREVENTION OF RAILWAY ACCIDENTS.

To the Editor of the Mechanic and Chemist.

SIR,—The alarming extent of accidents and loss of life which have occurred of late on the various railways, render it truly lamentable that our laws should be so framed as to put a check upon mechanical improvement, and thereby place the prevention of those accidents almost entirely upon the humanity of inventers. The terrible shock which has been given to the feelings of the nation by these heart-rending occurrences, is a proof that the nation suffers in a ratio with individuals, from the operation of our cruel and wicked patent laws. I do not hesitate to say that, had merit been adequately rewarded, it would not have required so many of these dreadful catastrophes to stimulate and arouse the inventive faculties of a disregarded portion of society to the improvement of railway travelling. When this piece of absolute injustice will cease to exist in our code of laws, I do not know; but that it becomes the duty of every man to lay aside personal interest when human life requires protection, is a fact which our feelings amply demonstrate. I consider the prevention of a great portion of these accidents to be involved in the following principle—viz., in regard to railways, is it possible to place in the object which is at rest, a power by which it shall have a complete and independent control over that which is in motion? To effect this purpose, I propose the following plan, as being the best I can devise at present:—



A is the main egress pipe of the boiler of a locomotive engine; B, a valve, having a long arm, which, when the valve is open, stands at right angles to the line of motion, and, when shut, parallel to it; D, an iron bar, capable of being placed horizontally, or raised perpendicular, so as to come within the range of the arm, C; E is a rope attached to the bar, P, and placed on the ingress line to every station, and of sufficient length to allow the engine time to stop, after the steam has been cut off; F G is the line of motion.

Now it will be evident at a glance, that the engine cannot move without the valve, B, is open; and, if the bar, D, be raised, it would be impossible for it to pass it, without the valve being instantly closed: the station keepers would, therefore, have a power by which they could stop an engine whenever they pleased. This bar might be placed at equal distances along the whole length of the line without ropes; so that if an engineer found himself behind his time, he might stop, raise one of the bars, and then he could proceed in safety. The next engineer, having his steam cut off by this bar, would know at once that there was danger on the line. There might be a permanent bar fixed at a proper distance from the terminus of every line, whereby no engine could enter the terminus station, without having its steam cut off at the proper place.

I remain, &c.

B. T.

Sheffield.

PREVENTION OF RAILWAY ACCIDENTS.

It is now ten years since the system of railway conveyance was first tested on the Liverpool and Manchester line. The result of that experiment was, perhaps, the most glorious and unqualified triumph ever achieved by human science; and

subsequent and more extensive experience has realized, and even surpassed the anticipations of the most sanguine and enthusiastic promoters of that great undertaking. The numerous and fearful accidents which have recently occurred on various lines of railway, lamentable and distressing as they are, especially to the sufferers and their immediate friends, cannot fairly be considered as valid arguments against the principle of steam locomotion. Very few accidents are occasioned by defects in the machinery, and still less by errors in the prescriptions of theory. In all the walks of life, we are surrounded with perils; the mariner is exposed to storms, pirates, famine, scurvy, and mutiny; in cities we are in danger of carts, cabs, coaches, chimneys, scaffoldings, fogs, fires, pickpockets, unclosed cellars; projecting scrapers, and orange-peel on the pavement; in the country, we find lightning, steeple-chasing, bulls, footpads, rioters, precipices, and incendiaries; in the midst of life we are threatened with death; and neither railroads, nor any other human invention can impart to man the right of saying, "to-morrow is mine." But although occasional accidents will ever be unavoidable, we ought not to relax our efforts to prevent them, as far as human foresight will permit. All accidents on railways may be classed under these two heads—mechanical and administrative. Of the former, the chief danger is the liability of engines to run off the rails when passing rapidly over a curved line; for this, we have already proposed a remedy, as effectual in its operation, as it is easy in execution—it is to form the curve on a concave spherical surface, whose radius is proportional to the assumed velocity of the train, inversely, and to the radius of the curve directly. Administrative faults will be best rectified by coroner's juries; heavy deodands, in cases of culpable negligence, will have more effect than all the arguments and expostulation that we, or anybody else, can possibly employ. As this is a subject which will probably occupy the attention of many of our readers, we have collected the following suggestions from various sources.

(From the "Leeds Mercury.")

We understand that Mr. Robert Stephenson, the engineer, is preparing a contrivance for attaching a *self-acting break* to the buffers of every carriage; this would act by the break being applied to the wheel as soon as the buffers of any two carriages came together. In case either of accident or of danger, as soon as the engine-driver turns off his steam, the buffers of the carriages come together; but unless breaks are instantly applied, the momentum of the train carries it a considerable distance before it can be stopped. If, then, a break were instantly and infallibly applied to *every* carriage as soon as the steam was turned off or any check experienced (such as the engine getting off the rails), the whole train at once would be converted into one long *sledge*, and the friction of the rails would bring it to a stand in much less time than is now possible. It seems to us, therefore, that such a contrivance as we have mentioned, will be one of the most valuable improvements that can be adopted on railways.

(From the same.)

I have observed, that when a collision or sudden stoppage of railway carriages takes place, any injury to the passengers generally arises from those sitting with their faces to the front of the train being thrown forward, either against the persons or backs of the seats opposite to them. It therefore appears to me worthy of consideration, in the future construction of railway passenger-carriages for great rate of speed, whether or not, it would be an improvement as regards safety, to make them with *single* instead of double boxes or divisions—that is, instead of a carriage having, for example, three divisions, each division containing two rows of seats opposite to each other, that it should have six divisions, each containing only one bench or row of seats. In this way the passengers would not face each other; and, were the carriages turned each trip, the passengers might sit whichever way the train was going, with their backs to the engine or front f the train. Even were the passengers to *ride forwards*, as it is called, the space between the back and front of the box being so much less than it is on the present plan of double-seated boxes, a passenger, if thrown forward by an unexpected stoppage, could not be so much injured in the narrow as in the wide box, and one passenger could not be dashed against another. The best practice would, however, be, to put the proposed carriages about upon the turning-table each trip, so that the passengers should ride backwards; and when an accident of the kind in question occurred, if the passengers kept their places, I am satisfied that comparatively little injury would be sustained, except in very extraordinary circumstances.

(From the same.)

It has occurred to me, that accidents by

trains being thrown off the rail, by persons wickedly placing obstacles thereon, might be prevented by the iron which precedes the wheels of the engine, being placed so as to remove obstacles on the *inside of the rail*, instead of merely removing what *is actually on* the rail. For instance, if a large stone is placed on the *inside of the rail*, the iron before the wheels of the engine would *not touch* it, because this iron runs exactly parallel with the rail, instead of removing what might be in the way of the flange of the wheel, and also actually higher than the rail.

(From the "Bath Chronicle.")

Let the valve which is used for turning on the steam to the working cylinders be made with a spring, so constructed as, in its action, always to shut off the steam, which in this case blows off through the safety valve. To this spring is connected a leather strap or rein. The engineer, on receiving the usual signal to start, gives the accustomed whistle, pulls the rein, and the steam, which was before blowing off through the safety-valve, is directed to the working cylinders, and will continue so long as the engineer holds the rein; but should he, from drowsiness or any other cause, relax his hold, the action of the spring immediately shuts off the steam, which, returning again to its former mode of escape, soon gives notice of the absence of the directing hand.

(From the same, by Dr. Wilkinson.)

Protective Plan Proposed.—To impress a sensation of security on the mind of every traveller by railway, is both the interest and duty of the managers of these extensive concerns; and to prevent the results arising from either of the causes above mentioned, I avail myself of this opportunity of submitting to the consideration of the directors, the adoption of a plan which would not be attended with much inconvenience, or any serious expense. It is adding to the present trains the great part of security attached to the atmospherical railway plan. To each locomotive engine let there be attached a strong iron cylinder, about eight feet long, and twelve inches in diameter. Into this cylinder let there be introduced a proportionately strong condensing piston-rod, projecting six feet or more in advance of the engine, and placed exactly in the centre, having the head two feet in diameter. Thus, in case of collision, the two piston-heads would first come into contact, and the progressive condensation of air would counteract the effects of any sudden change of motion. Two cylinders of the above dimensions, if condensed to two feet, would create a resisting power nearly amounting to eight tons. As the disturbing power resulting from one train overtaking another, is no ways so great as the former, the extremity of the train being provided with a strong rod of iron, would be equally well protected, as in the former case, with two cylinders.

A correspondent of the *Times* recommends one or more trucks or carriages to be always kept empty, should be placed at the end of every train, and also, properly ballasted, at the head of the passengers' carriages. Experience having shown, in almost every instance, that an accident is more likely to be fatal to persons in the first or last carriages of a train, than to those who occupy a middle position; it is, therefore, desirable, that the risk should be broken, by falling upon an *inert* material, which might be constructed with this especial view, before reaching the vehicles in which passengers are conveyed.

POWER OF STEAM.

To the Editor of the Mechanic and Chemist.

SIR,—I send you the following for insertion; if you think it worthy of a place in the "Mechanic," you will oblige,

Yours, &c.

G. MITCHELL.

The power of a high-pressure engine is found by multiplying the force of steam in the boiler in pounds per square inch, by the decimal .6; the quotient will be the effective pressure. There is a high-pressure engine in this neighbourhood connected with a water-wheel: when the engine drives all the work, the whole force of steam requisite to drive at full speed, was 18 lbs. per square inch; but when the water-wheel was connected, a force of 12 lbs. would drive at full speed; hence the difference is 6 lbs. per square inch. Then, by the above rule, the effective pressure, 6 lbs. $\times$ .6 = 3.6 lbs. per square inch. The area of cylinder is 154 square inches, which, multiplied by 3.6 lbs. = 554.4, and this $\times$ 240 feet, the velocity of the pestle of the engine gives 133056 lbs., a foot per minute, and divided by 32000 $=4\frac{2}{10}$ horses' power, which is the effect of the water-wheel.

Now, in the above experiment, the discharge of water into the buckets of the

wheel was 110 cubic feet per minute, with a fall of 30 feet. To calculate the effect of the above:—According to the deductions of "Smeaton's Experiments," the effect of a water-wheel is .66 of the power of the water: a cubic foot of water weighs 62½ lbs.; this, multiplied by the decimal .66 = 41¼—say 41 lbs.; then 110 cubic feet, as above, multiplied by 41 lbs. = 4510, and by 30 feet fall = 185300 lbs.; this, divided by 32000 = $4\frac{2}{10}$, or rather more than the effect found by the engine as above. If the decimal for a condensing engine be compared in the same way, it will be found correct. See page 230 of this work.

COOKSON'S PATENT PROCESS FOR OBTAINING COPPER AND OTHER METALS FROM METALLIC ORES.

(Abstract of Specification.)

This invention is applicable to those metallic ores which contain copper in combination with sulphur—which, for the purpose of reference, I call sulphureous ores—and also to those which contain copper in combination with oxygen, which, for the purpose of reference, I call oxide ores; and it consists in obtaining copper and other metals, and sulphuretted hydrogen gas, and sulphurous acid, from these sulphureous ores, and in obtaining copper from these oxide ores. The sulphureous ores contain iron in combination with the sulphur, and sometimes small quantities of silver; and the oxide ores also sometimes contain small quantities of silver.

In my first process, I use those sulphureous ores which contain a large proportion of iron and sulphur, and a small proportion of earthy matter; and, for the purpose of reference, I call these ores rich sulphureous ores. I reduce sulphuret of iron contained in these ores to proto-sulphuret, by distilling sulphur from such sulphuret. I then dissolve iron contained in the proto-sulphuret by muriatic acid or sulphuric acid, and thus obtain sulphuretted hydrogen gas and iron, in the state of muriate or sulphate of iron, as the case may be. The sulphuret of copper and the silver (if the ore employed contained silver) remain undissolved, and metallic copper may be obtained from this sulphuret, by the means usually employed to obtain metallic copper from native copper ores, but by the means hereinafter described; for these purposes I obtain from the undissolved residuum, metallic copper and sulphurous acid, and also silver, if the sulphureous ore employed contained silver.

In my second process, I roast the sulphureous ores at a bright-red heat, while they are exposed to the action of atmospheric air, until the sulphurets of iron and copper, which such ores contain, are converted into oxides; and by mixing the roasted ores with muriatic acid, I dissolve the oxide of copper, and obtain muriate of copper, from which metallic copper may be obtained.

In my third process, I also roast the sulphureous ores at a bright-red heat, while they are exposed to the action of atmospheric air; but I discontinue this roasting when the greater part of the sulphuret of iron has been converted into oxide. The copper remains in the state of sulphuret, and, by exposing the roasted ores to the action of atmospheric air at a suitable heat, I convert this sulphuret into sulphate, and the remaining sulphuret of iron becomes oxidized. I then separate the sulphate of copper by dissolving it, and thus obtain oxide of iron (from which metallic iron may be obtained) and sulphate of copper, from which I obtain metallic copper and sulphurous acid.

In my fourth process, I roast the sulphureous ores in the same manner as in my third process, until about one-half of the sulphuret of iron has been converted into oxide; no part of the sulphuret of copper being converted into oxide. I then flux the roasted ores in mixture with carbonaceous matter, and thus obtain a regule containing sulphuret of iron in the state of proto-sulphuret (capable of being decomposed by acid), and sulphuret of copper and also silver, if the ore employed contained silver. I then dissolve iron contained in the regule by muriatic acid or sulphuric acid, and thus obtain sulphuretted hydrogen gas and muriate or sulphate of iron, as the case may be. The sulphuret of copper and the silver (if the ore employed contained silver) remain undissolved; and metallic copper may be obtained from this sulphur by the means usually employed to obtain copper from native copper ores, or this sulphuret of copper may be converted into sulphate of copper and metallic copper, and sulphurous acid obtained therefrom, by the means mentioned for these purposes in describing my third process; and in such case silver (if the sulphureous ore employed contained silver) may be obtained from the residuum remaining after the sulphate of copper has been dissolved. If the sulphureous ore employed did not contain silver, I use the sulphuret of cop-

per obtained in this my fourth process, to mix with sulphate of copper, as mentioned in describing my third process, instead of converting it into sulphate.

The fifth process is applicable only to the oxide ores. By digesting these ores with muriatic acid or sulphuric acid, I dissolve oxide of copper, and obtain either muriate of copper (from which metallic copper may be obtained) or sulphate of copper, from which metallic copper and sulphurous acid may be obtained, by the means mentioned for that purpose in describing my third process.

I will now describe more particularly, the manner in which I carry my several processes into effect.

In carrying into effect my first process, I put the rich sulphureous ore which I employ, into an oven or retort, constructed of fire-bricks or fire-clay, in a manner similar to the ovens or retorts constructed of such materials which are used for distilling gas from coal; and I apply heat to such oven or retort, in the same manner as heat is applied in making coal gas. I thus subject the ore to a red heat to distil off sulphur; but care must be taken to avoid raising the heat to such a temperature as will cause the ore to become fused; and I continue this heat until nearly the whole of the sulphuret of iron contained in the ore is reduced to proto-sulphuret. I then withdraw the ore from the oven or retort, and put it into a vessel (which I prefer to construct of lead or of wood), fitted with a gas tube for conveying off gas, and with pipes for supplying steam and muriatic acid or sulphuric acid; and after I have closed this vessel air tight, I introduce muriatic acid or sulphuric acid into it; and I inject steam into the liquid to assist the action of the acid. The proto-sulphuret of iron is decomposed by the action of the acid, sulphuretted hydrogen gas passes off through the gas tube into a gasometer, and I obtain muriate or sulphate of iron (as the case may be) in solution. I then draw off the solution and wash the residuum with water, or separate a farther quantity of muriate or sulphate of iron. This residuum contains sulphuret of copper and also silver (if the sulphureous ore which I employed contained silver), and metallic copper may be obtained from this sulphuret, by the means usually employed to obtain copper from native copper ores, or otherwise metallic copper and sulphurous acid, and also silver (if the sulphureous ore employed contained silver) may be obtained from the residuum.

In my second process, I put the sulphureous ore into an oven or furnace, which has a current of atmospheric air through it; and I roast the ore in this oven or furnace at a bright-red heat. If the ore which I employ is in powder, I either continue this roasting until the sulphurets are completely converted into oxides, or when a great portion of the sulphur contained in the ore has been driven off, I remove the roasted ore to a common reverberatory furnace, and complete this conversion in such furnace by the action of atmospheric air at a red heat; but if the ore which I employ is not in powder, then I find it necessary to pulverize the ore, when a great portion of the sulphur has been driven off, and afterwards to complete the conversion of the sulphurets into oxides, by the means before mentioned for that purpose. After the sulphurets have been thus completely converted into oxides, I mix the roasted ore with muriatic acid, and thus dissolve the oxide of copper; and I assist this solution by frequently stirring the mixture. I then draw off the solution, and I obtain metallic copper from this solution, either by decomposing the muriate of copper which it contains by metallic iron, or by the other means hereinafter described, for obtaining metallic copper from solutions of copper by means of lime.

In my third process, I roast the sulphureous ore, which I employ in the same manner as I have already mentioned, in describing my second process; and I use a similar oven or furnace for that purpose; but I withdraw the roasted ore from such oven or furnace, when the greater part of the sulphuret of iron contained in the ore has been converted into oxide, and before any part of the sulphuret of copper is converted into oxide. And, if this roasted ore is not already in powder, I pulverize it; I then put it into an oven or furnace, through which a current of atmospheric air is passing, and heat it until it attains such a red heat, as is just perceptible in the absence of day-light. I thus cause the sulphuret of copper contained in the ore, to absorb oxygen from the current of atmospheric air passing through the oven or furnace; and, in order to promote this absorption, I frequently rake the ore during the operation, for the purpose of exposing fresh surfaces to the action of the atmospheric air. I continue this operation until the sulphuret of copper is converted into sulphate, and I then lixiviate the product of the operation with water, and thus dissolve the sulphate of copper; and I draw off this solution and wash the residuum, to separate a farther quantity of

sulphate of copper. Metallic copper may be obtained from the solution of sulphate of copper obtained by these means, either by precipitating copper by means of metallic iron, or by precipitating oxide of copper from the solution by means of cream of lime, and afterwards washing such oxide with water to separate the sulphate of lime; and mixing the oxide thus washed with carbon, and then reducing the oxide into metallic copper, by exposing this mixture to a high temperature. But I obtain metallic copper and also sulphurous acid from this solution of sulphate of copper. For this purpose I evaporate the solution to dryness, and mix the dry sulphate with half its weight of the sulphuret of copper obtained by my fourth process. I pulverize this mixture, and expose it to a red heat in a closed retort or oven (which I prefer to construct of fire-clay or fire-brick), and thus drive off sulphurous acid suitable for the manufacture of sulphuric acid. The residuum in the retort or oven contains a great proportion of metallic copper and some oxide of copper; and I separate oxide by washing the residuum with water, or by dissolving oxide by muriatic acid or sulphuric acid; and I afterwards melt the residuum with suitable fluxes to obtain metallic copper; or, otherwise, I obtain metallic copper from the residuum, by fluxing it as it is taken from the retort or oven, in mixture with carbonaceous matter and suitable fluxes. If the ore is not heated in the operation of converting sulphuret of copper into sulphate, to a temperature exceeding such a red heat as is above described, the sulphate will not become decomposed; but if such ore is heated to a temperature much exceeding such red heat, a portion of the sulphate will become decomposed, and be converted into oxide of copper; and, in this case, this oxide may be extracted from the residuum by dissolving the oxide by muriatic acid; and metallic copper may be obtained from such solution by precipitation with iron, or by means of lime, in the manner hereinbefore described for obtaining metallic copper from a solution of sulphate of copper, by means of iron or lime. The residuum which remains, after dissolving and separating the sulphate of copper and the oxide of copper (if any such oxide has been produced), contains oxide of iron, from which metallic iron may be obtained, by the means usually employed for obtaining metallic iron from native oxide of iron.

In my fourth process, I also roast the sulphureous ore, which I employ in the same manner as I have already mentioned in describing my second process; and I use a similar oven or furnace for that purpose, and I withdraw the roasted ore from such oven or furnace, before the sulphuret of copper is converted into oxide; but I prefer to withdraw it as soon as about one-half of the sulphuret of iron has been converted into oxide of iron. I ascertain the proportion of iron which the roasted ore contains, and for every four parts of iron contained therein, I add one part of powdered coke or coal. And, for the purpose of assisting the fluxing of the ore, I add fluxes to the powdered coke or coal and roasted ore; and I regulate the quality and quantity of the fluxes which I employ, in the same manner and upon the same principles as these are regulated in the ordinary operations of copper smelting. I mix together the roasted ore, the coke or coal, and the fluxes, and I put the mixture into a furnace, similar to the furnaces which are used for fluxing in the ordinary operations of copper smelting; and I cause the mixture to become fluxed, in the same manner as fluxing is usually effected in these operations. I thus obtain a slag or scoria, consisting of the earthy matters which were contained in the ore, and a regule containing proto-sulphuret of iron (capable of being decomposed by muriatic acid or sulphuric acid) and sulphuret of copper, and also silver, if the sulphureous ore employed contained silver. When the mixture has been completely fluxed, I cause the regule to run off from the fluxing furnace into water, for the purpose of granulating it; and, when it has been thus granulated, I prefer to powder it, and I put it into a vessel (which I prefer to construct of lead or of wood) fitted with a gas-tube for conveying off gas, and with pipes for supplying steam and muriatic acid or sulphuric acid; and, after I have closed this vessel air tight, I introduce muriatic acid or sulphuric acid into it, and I inject steam into the liquid to assist the action of the acid. The proto-sulphuret of iron is decomposed by the action of the acid, sulphuretted hydrogen gas passes off through the gas-tube into a gasometer, and I obtain muriate or sulphate of iron (as the case may be) in solution; I then draw off the solution and wash the undissolved residuum with water, to separate a farther quantity of muriate or sulphate of iron. This residuum contains sulphuret of copper and also silver (if the sulphureous ore which I employed contained silver); and metallic copper may be obtained from this sulphuret by the means usually employed to obtain copper from native copper ores;

but I prefer to convert sulphuret of copper, thus obtained, into sulphate, and to obtain metallic copper and sulphurous acid from such sulphate, by the means which I have already described for these purposes in describing my third process. When the sulphuret of copper is converted into sulphate, and this sulphate is dissolved, and the solution drawn off, the undissolved residuum contains such silver as was present in the sulphureous ore employed; and silver in a metallic state may be obtained from this residuum, by some of the processes usually employed for extracting silver from silver ores. If the sulphureous ore which I employ in this my fourth process, does not contain silver, then I use the sulphuret of copper, obtained in this process, with dry sulphate, as described in my third process.

In my fifth process, I use only the oxide ores. I reduce the ore which I employ to powder, and then mix it with muriatic acid or sulphuric acid; and I assist the action of the acid employed, by injecting steam into the mixture. I thus dissolve the oxide of copper contained in the ore, and obtain muriate or sulphate of copper (as the case may be) in solution. If muriatic acid has been used, I obtain metallic copper from the solution of muriate of copper by means of iron or lime, as mentioned, for the purpose of obtaining metallic copper from solution of sulphate of copper by iron or lime, in describing my third process. And if sulphuric acid has been used, I obtain metallic copper and sulphurous acid from the sulphate of copper, by the means which I have hereinbefore described, for obtaining metallic copper and sulphurous acid from sulphate of copper, in describing my third process.

SALT.

An analysis of various kinds of foreign and domestic salt was made, some years ago, by Dr. Henry, of Manchester, in order to ascertain the respective purity of each. From his experiments it appeared, that that called the fishery salt, produced in Cheshire, contains 983¾ parts of pure muriate of soda in 1000, the remaining 16¼ parts being chiefly of sulphate of lime. The salt formed by simply crushing the rock of the Cheshire mines, is little inferior in purity, being 983¼ parts of muriate of soda to 6½ sulphate of lime, 10 of insoluble earthy matter, and various minute proportions of muriates and sulphates. The Scotch common salt has only 935½ of pure muriate of soda, to 28 of muriate of magnesia, 4 of earthy matter, 15 sulphate of lime, and 17½ sulphate of magnesia. The French salt varies in purity between the common or Scotch salt, and the Cheshire kinds.

Salt crystallizes in cubes, which are sometimes grouped together in various ways, and, not unfrequently, form hollow quadrangular pyramids. In fire, it decrepitates (burns till it has ceased to crackle), melts, and is at length volatilized. When pure, it is not deliquescent (will not dissolve) One part is soluble in 2½ of cold water, or in little less of hot; so that it cannot be crystallized but by evaporation.

Salt is indispensable to man, as a component part of his food. It is stated, that with every bushel of flour, about one pound of salt is used in making bread; and thus, it may be presumed that, in bread alone, every adult consumes about two ounces of salt weekly. The omission of a proper quantity of it in our food favours the engendering of worms. We read, that when the ancient laws of Holland ordained men to be kept on bread alone, unmixed with salt, as the severest punishment that could be inflicted upon them in their moist climate, the effect was horrible; the wretched criminals are said to have been devoured by worms. Mungo Park mentions that he suffered great inconvenience from the scarcity of this article :—"The long use of vegetable food creates so painful a longing for salt, that no words can sufficiently describe it." Almost all graminivorous animals seem to have the same necessity for the use of salt in their food as man. An immunity from the rot is generally enjoyed by sheep fed on the salt marshes, or when salt is regularly mixed with their food. (See Reports of Lord Somerville.) In the States of La Plata, in South America, the sheep and cattle, where they discover a pit of salt clay, rush to feed upon it; and, in the struggle, many are trodden to death. In Upper Canada, the cattle have abundance of wild pasture to browze on in the woods; but once a-fortnight they return to the farm of their own accord, in order to obtain a little salt; and, when they have eaten it, mixed with their fodder, return again to the woods. Salt is now used extensively in England and in all Europe, for fattening cattle. In Spain, they attribute the fineness of their wool to the quantities of salt given to the sheep. In England, 1000 sheep consume at the rate of a ton of salt annually. About 1,000,000 tons are annually given to animals in this country.

Salt is antiseptic—that is, it counteracts putrefaction. This property is valuable, inasmuch as it enables the superabundant

productions of our country to be transmitted, in a sound and wholesome state, to a distant land. It must be borne in mind, however, that salt, when employed as a means of preserving meat, hardens it, and impairs its nutritive power, as well as renders it more difficult to digest. Such meat is less nourishing, but more stimulating, than fresh meat; and its long-continued use produces what has been termed the *disjunctive* inflammation, owing to which, old wounds, &c., break open, and fractured bones separate after re-union.

C. DAVIDSON.

(To be continued.)

BLACKWALL RAILWAY.

THE following may serve as a useful hint to those who have claims upon railway and other chartered companies, for property required in the construction of public works.

In arranging for the property on the extension line of the Blackwall Railway, between the Minories and Fenchurch Street, the Company have only yet had to issue seven precepts for the summoning of juries, and the result is as follows:—

	Claimed.	Granted.
Boulton and Watt, engineers, Fenchurch Street	£810	£240
William Claridge, wine merchant, Gould Square	3401	800
Grant Preston, brazier, Minories	3611	1500
Samuel Smith, oilman, Crutched Friars	1736	750
William Chillingworth, wine-merchant, Gould Square	3972	1000
W. A. Seal, wholesale clothes salesman, Minories	2652	1500
John Jonas, carman, Crutched Friars	1626	210
Total	£17,808	£6000
Making a difference of		£11,808 !

It is beyond the duty of a good citizen to injure his own family for the promotion of any object of slight national benefit; but when we see persons attempting to take unfair advantage, by making exorbitant and unconscionable demands, we cannot help rejoicing to find their purpose defeated by the interposition of a jury. The above facts clearly show the liberal dealing of the Company, who have only claimed the protection of a jury, in cases of the grossest attempts at extortion.

ECONOMY OF FUEL.

To the Editor of the Mechanic and Chemist.

SIR,—As the time of year is come that fuel is a very valuable article, and, I think, particularly so in London; I beg to offer for your insertion a plan I have adopted to save fuel—you know, to save is to gain: you cannot imagine the quantity that is thrown away every day in large towns. I find the smallest bits of ashes, when the dust is shaken from it, will burn and make good fires, especially with a little fresh coals in front. I have a sieve made ten holes each way—that is, one hundred holes to the square inch—to shake the ashes in; what goes through is dust, and all that stay in the sieve will make good fuel. I think a little box might be made with a sieve in it, so as to just turn a handle, and the ashes would be sifted in the box clean from dust, and have drawers for the coal ashes and one for dust.

Tavistock. A. S.

[This is practised by many in London, though neglected by others; it prevents considerable waste, and, we trust, that the hint will prove serviceable to some portion of our readers.—ED.]

MISCELLANEA.

Curious Phenomenon.—Change of Colour.— A portrait of a celebrated theologian had been painted some years by an artist who was known to have considerable skill in the management of his materials. The very reverend individual was represented in a rich velvet dress, which was not a little admired, and which attracted the eye of the spectator almost more than the face. The picture, however, from the effect of dust and the smoke of lamps, had lost much of its original vivacity. It was, therefore, placed in the hands of a painter, who was to clean it, and give it a fresh coat of varnish. This person began his operations by carefully washing the picture with a

sponge; no sooner, however, had he gone over the surface once or twice, and wiped away the first dirt, than, to his astonishment, the *black velvet* dress changed suddenly to a *light-blue plush*, which gave the ecclesiastic a very secular, though somewhat old-fashioned, appearance. The painter did not venture to go on with his washing; he could not comprehend how a light blue should be the ground of the deepest black, still less how he could so suddenly have removed a glazing colour capable of converting the one tint into the other. At all events, he was not a little disconcerted at having spoiled the picture to such an extent. Nothing to characterise the ecclesiastic remained, but the rich-curled round wig, which made the exchange of a faded plush for a handsome new velvet dress, far from desirable. Meanwhile, the mischief appeared irreparable, and the good artist, having turned the picture to the wall, retired to rest with a mind ill at ease. But what was his joy next morning, when, on examining the picture, he beheld the black velvet dress in its full splendour. He could not refrain from again wetting a corner, upon which the blue colour again appeared, and after a time vanished. On hearing of this phenomenon, I went at once to see the miraculous picture. A wet sponge was passed over it in my presence, and the change quickly took place. I saw a somewhat faded, but decidedly light-blue plush dress, the folds under the arm being indicated by some brown strokes. I explained this appearance to myself by the doctrine of the semi-transparent medium. The painter, in order to give additional depth to his black, may have passed some particular varnish over it; on being washed, this varnish imbibed some moisture, and hence became semi-opaque, in consequence of which, the black underneath immediately appeared blue.—*Goethe's Theory of Colours.*

Magnificent Clocks.—Two very extraordinary clocks were, some time ago, presented by the East India Company, to the Emperor of China, being entirely manufactured by British artists. The Chinese entertain a peculiar prejudice, that all works of art, and ornamental objects, should be in pairs; a pair of pictures, with them, must not merely represent similar subjects, but they must be exactly alike in every detail, except that they will sometimes allow them to be reversed, as a copper-plate would be compared with an impression taken from it. They will not buy a single watch, but must have two exactly alike; one hanging at each side of them: and the same whim extends to shells and almost every object esteemed for beauty or ornament, whether natural or artificial. In conformity with this puerile *taste*, it was necessary to present his Celestial Majesty with two clocks. They were in the form of chariots, each of which contained a lady seated, leaning her right hand on a part of the chariot, under which was a clock, little larger than a shilling, that struck, repeated, and went for eight days without requiring winding-up. A bird was on the lady's finger, finely modelled, and set with diamonds and rubies, with its wings expanded as if to fly, and which was made to flutter for a considerable time, on touching a diamond button. The body of this curious bird, which contained the machinery which animated it, was less than the sixteenth part of an inch. In the lady's left hand was a golden tube, with a small round box on the top, to which was fixed a circular ornament, set with diamonds, which went round in three hours. A double umbrella was over the lady's head, supported by a small fluted pillar, and under which was a bell that struck the hour, though apparently unconnected with the clock; and at the lady's feet was a golden dog, before which were two birds, set with precious stones, and apparently flying away with the chariot, which, from another secret motion, is contrived to run in any direction; while a boy appears to push it forward. There were also flowers, ornaments, and a flying dragon, all set with precious stones, or formed of them; and the rest was made of gold, most curiously executed, and presenting a wonderful specimen of ingenuity and talent.

Cotton Mills of Messrs. Birley and Co., at Manchester. 1839.—The number of hands employed by this firm is 1600, whose wages annually amount to the sum of 40,000*l.* The amount of moving power is equivalent to the labour of 397 horses. The number of spindles in the mills is about 80,000. The annual consumption of raw cotton is about 4,000,000 lbs. weight. The annual consumption of coal is 8000 tons. It will perhaps excite surprise, in a person unacquainted with the nature of machinery, when informed that the annual consumption of oil, for the purpose of oiling the machinery, is about 5,000 gallons; and the consumption of tallow, for the same purpose, 50 cwt. The annual cost of gas is 600*l.* One room alone, belonging to this firm, contains upwards of 600 power looms. The establishment in which the fabric is manufactured for water-proof clothing—such as Macintosh cloaks—belongs to Messrs. Birley and Co., and is part of their concern. The number of hands employed in this business varies from 200 to 600. The immense amount of 250,000 lbs. weight of India-rubber is annually consumed in the process of manufacture: to dissolve which, 100,000 gallons of spirit are employed.—*Guide to Manchester.*

Violet-coloured Gas.—Put three or four grains of iodine into a small test tube, and seal the other extremity of the tube hermetically. If the tube be gently warmed over a candle, the iodine becomes converted into a beautiful violet-coloured gas or vapour, which condenses again into minute brilliant metallic crystals of a blueish-black colour, when the tube is suffered to grow cold; and this experiment may be repeated with the same tube for any number of times.

To produce an Orange-coloured Flame.—Put muriate of lime, deprived of its water of crystallization, into an iron ladle; cover it with spirits of wine, and cause it to burn in the manner stated. To prepare muriate of lime, dissolve common marble in muriatic acid, and evaporate the solution to perfect dryness.

To produce Yellow Flame.—This may be effected by most of the muriates, as common salt, or by nitre, when the salts are added in the proportion of three parts of common salt or nitre to

one of alcohol; the flame produced is a dim yellow.

To produce any Emerald-green Flame.—Cause alcohol to burn in a ladle upon nitrate of copper; let copper clippings or filings be dissolved in a sufficient quantity of nitric acid of a moderate strength; when no farther effervescence ensues, boil the acid gently upon the copper until a pellicle appears; decant the solution evaporated slowly, and, when a very strong pellicle is formed, suffer it to crystallize; the salt is of a fine blue colour.

Easy Method of Breaking Glass in any required Direction.—Dip a piece of worsted thread into spirits of turpentine; wrap it round the glass in the direction you require it to be broken; then set fire to the thread: or apply a red-hot wire, a quarter of an inch thick, round the glass, and if it does not immediately crack, throw cold water upon it while the wire remains hot. By this means, glass that is broken may often be fashioned and rendered useful for a variety of chemical purposes.

Singular Instantaneous Crystallization. — Make a concentrated solution of sulphate of soda or Glauber's salt, by adding portions of it gradually to water kept boiling, till this fluid dissolves no more (half-an-ounce of boiling water will dissolve about two ounces of salt); having done this, pour the solution while boiling hot into common medicine phials previously warmed, and immediately cork them, or tie slips of wetted bladder over the orifice of the phials, to exclude the access of air to the solution; this being done, set the phials by in a quiet place, without shaking. The solution will cool to the temperature of the air, and remain perfectly fluid; but the moment the cork has been drawn, and atmospheric air becomes admitted, it will begin to crystallize, on its upper surface, in fine satin-like crystals, which shoot downwards in a few seconds, like a dense cloud; as so much heat becomes evolved, as to make the phial very sensibly warm to the hands. When the crystallization is accomplished, the whole mass is usually so completely solidified, that, on inverting the vessel, not a drop of it falls out. If the crystallization should not immediately ensue on opening the phial, the slightest agitation, or the dropping in a minute crystal of the same salt, or by merely touching it with it, will generally cause the crystalline process to take place. It may be observed, that the same mass of salt will answer any number of times the same purpose; all that is necessary to be done is, to place the phial in boiling water. All the salt is again completely liquified and corked up as before.

Indelible Ink. — Take oil of lavender 200 grains; gum copal, in powder, twenty-five grains, and lamp-black from two and a half to three grains; with the aid of a gentle heat dissolve the copal in the oil of lavender, in a small flask or phial, and then mix the livigated lamp-black with the solution; after a repose of some hours, the ink must be shaken, before used, or stirred with an iron wire, and, if too thick, it must be diluted with a little oil of lavender. This composition, which was first recommended by Mr. Close, is very useful in chemical laboratories for writing with it the labels of bottles containing acids, or such bottles as are exposed to the acid fumes in a laboratory. W. E., Jun.

To make a Bengal Light.—Nitre, 8 oz.; sulphur, 6 oz.; red lead, 4 oz.; powder, 2 oz.

Blue Fire.—Antimony, 2 oz.; sulphur, 4 oz.; nitre, 6 oz.

Red Fire.—Nitrate of strontian, 2 oz.; sulphur, 4 drachms; antimony, 2 drachms and 2 grains; charcoal, 1 scruple and 12 grains; oxymuriate of potass, 1 drachm 1 scruple.

Another Receipt.—Nitrate of strontian, 2 oz.; chlorate of potass, 6 dwts.; charcoal, 6 dwts.; powder, 6 dwts.

China Gerb Fire.—Powder, 8 oz.; nitre, 2 oz.; steel dust, 5 oz.

White Fire.—Nitre, 1 lb.; sulphur, 11 oz.; black antimony, 3 oz.; red antimony, ½ oz.

Flower Pot.—Coal, 1 oz.; nitre, 1 oz.; sulphur, 1 oz.; powder, 2 oz.

E. C. B. H.

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street. — Thursday, December 17, Cowden Clarke, Esq., on Butler. At half-past eight.

Chemical and Philosophical Society, No. 241, High Street, Shoreditch.—Wednesday, December 16, Conversazione. At half-past eight precisely.

Pestalozzian Academy, Worship Square.—Tuesday, December 15, Major Beniowski, on Mnemonics.

Bermondsey and Rotherhithe Literary and Scientific Institution, 4½, Church Street, Rotherhithe.—Monday, Dec. 14, Discussion. At half-past eight precisely.

QUERIES.

In looking over some of your back Numbers, I saw a receipt for painting a winter scene, so that, on holding it to the fire, it turned to summer. The ingredients were muriate of copper, muriate of cobalt, and acetate of cobalt. Now, I want to know if you, or any of your correspondents, can inform me where I can purchase the above; whether at a chemist's or colour warehouse, or elsewhere? For, supposing that I could get them at a chemist's shop, I went into rather a large one, where there was a young roll-em-up, who (by dint of reading all the inscriptions on the drawers and dummies, and labels on the bottles) knew the names of all the ingredients in common use; but when I asked for muriate of copper, he very confidently assured me that he did not believe that there was such a thing. This putting me in a query, induced me to write to you for information. If any of your correspondents will stoop through a maze of learning to inform a young ignoramus how to paint or stain glass, for

a magic lantern, I should be much obliged to them.

J. W.

What is the most adhesive cement by which to fix wood firmly to brass? Putty will not answer my purpose, remaining too long soft. What metals, besides iron and steel, does the magnet attract; and for which of the metals does the magnet not show any inclination? Will the coming in contact with any of the latter injure a magnet? Perhaps some correspondent replying to the latter questions may favour me with the greatest weight a magnet (single or several combined) has been known to lift—what the probable price of such a magnet may be—and where the best and cheapest, large and prepared magnets can be purchased? NOVICE.

A receipt for making a liquid for steeping seed-wheat in, previous to sowing, that will effectually prevent smut, rust, blight, and other diseases to which it is liable; and at the same time to add a fertilizing property to the grain, and assist its germinating? 2. What are green and yellow basilicon made of; and how are they made? 3. A receipt for making the best kind of black Japan varnish for leather, that will remain as durable as the leather itself? 4. How are eclipses of the sun and moon calculated with the utmost exactness? 5. A receipt for making a tincture or mixture of oils, for applying to fresh wounds, such as cuts, scratches, bruises, abrasions, &c., which mechanics who work with edge-tools, are always liable to? 6. Which is the best work known, on making and using all kinds of paints, colours, oils, and varnishes?

D. E. M. S.

[Several of the foregoing queries it will be found difficult or impossible to answer, to the full extent required; but as they are not devoid of general interest, we insert them, with the hope that they may elicit some information from those of our correspondents who are conversant with the subjects referred to.—ED.]

To make the best scarlet water-colour; and if there is any way of dissolving vermilion red in gum-water; and how to extract the most colour from Brazil wood, and the best mordant to brighten the colour.

THOS. SIMMONS.

ANSWERS TO QUERIES.

A correspondent, in your 116th Number, wishes to have a description of the different pipes in hand (barrel) organs. In answer to which I beg to inform him, that it depends entirely upon what stops he intends having in his organ; as there are nearly as many different kinds as there are days in the year, all requiring different dimensions; but, for his information, I will just select three of the most commonly used—viz., open diapason, principal, and fifteenth, all of which are usually made of metal, but can be made of wood. The note middle C, of the principal, measures eleven inches from the mouth upwards, the size of the foot being of no consequence whatever; its use is to carry wind to the other part. The same note in the open diapason measures twenty-two inches, it being an octave lower than the principal; and middle C, of the fifteenth, measures five-and-a-half inches, it being an octave higher than principal; and every octave above being half the length of its predecessor, and every octave below double the length. The width of the pipe is not material, providing the pipes in the same stop bear a certain proportion to each other—viz., that every pipe should be two-thirds the diameter of its octave below; and so of the rest.

W. W.

To make Burnt Steel fit for Use.—As I am in the habit of using that article, in many instances I have over heated the steel, and thereby, to appearance, spoiled it. The following directions will, I think, answer "A. M. A.'s" purpose:—If the steel is rendered coarse by over heat, put it into the fire, bring it to a blood-red heat, quench it in water, repeat the operation six times, and the steel will be brought back to its former state, and fit for the finest work. Be sure that it is hardened each time of quenching, but at the lowest possible heat, otherwise the experiment will fail. WM. SERVICE.

TO CORRESPONDENTS.

W. W.—*The furnace required for casting articles in brass, not exceeding six or eight pounds may be about eight inches square, and two feet deep. To prevent the crucible from cracking, put it into a slow fire with its bottom upwards; coke it up, and let it remain till it becomes red hot, and then place it in its proper position, and when the fire is well up, put in the metal. Brass is injured by exposure to too great a heat, or by remaining too long in a state of fusion; the zinc which enters into its composition is liable to fly off.*

A. C.—*All liquid blacking that we have seen, is subject to deposit the solid ingredients at the bottom of the bottle; this might be partly prevented, by the addition of some gummy substance or size; but it is not necessary, if care be taken to mix it properly at the time of using it.*

J. Banks.—*The question he proposes, has already been discussed and settled in the "Mechanic." No operation of multiplying can possibly be performed, unless one or both of the quantities involved be abstract numbers—say* $19, \frac{19}{20}, \frac{11}{240}$, *and* $\frac{3}{960}$, *and all difficulty vanishes; but if the different amounts represent different things and different values, the question is absurd, and admits of no rational answer.*

T. B.—*No reward is offered for perpetual motion. We will endeavour to obtain the other information he desires.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by DOUDNEY & SCRYMGOUR (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE

MECHANIC AND CHEMIST.

A MAGAZINE OF THE ARTS AND SCIENCES.

No. 125, NEW SERIES. | SATURDAY, DEC. 19, 1840. PRICE ONE PENNY. | No. 246, OLD SERIES.

SUBMARINE STEAM-VESSEL.

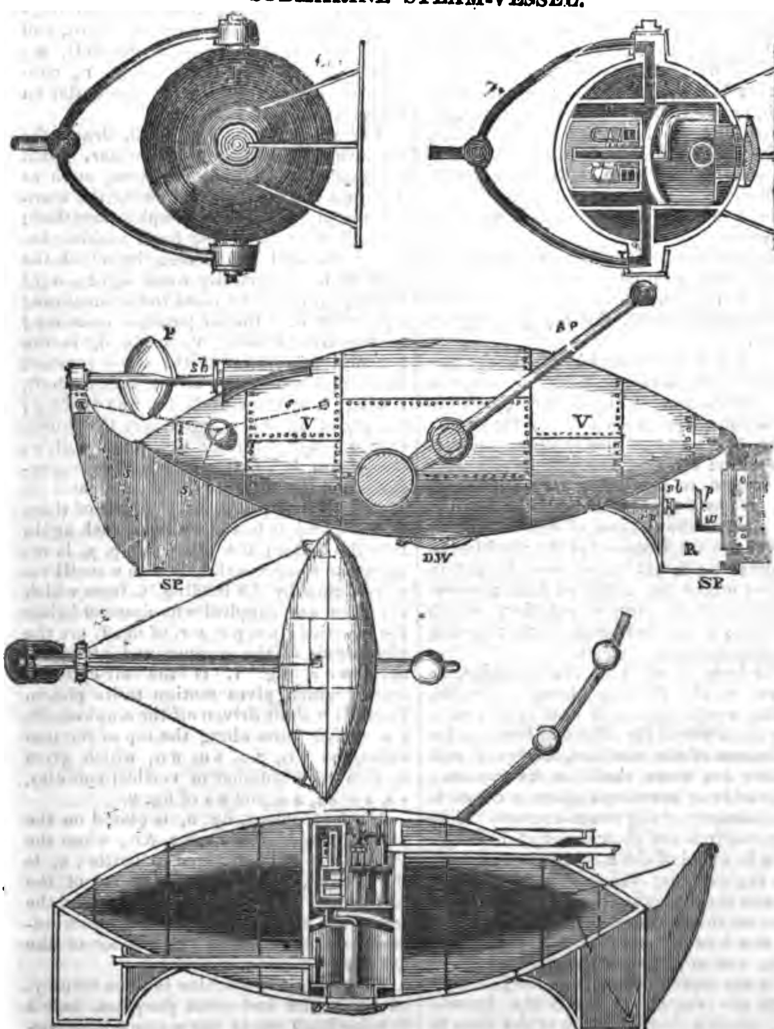


Fig. 6.

City Press, 1, Long Lane: Doudney and Scrymgour.

SUBMARINE STEAM-VESSEL.

(See Engraving, front page.)

SIR,—I again request the pleasure to acquaint you of another machine, which, I believe, will realize great and important discoveries in all connected with submarine affairs, that for ever has been hid in the bosom of old ocean, from mortal view and ken.

The picture of this machine, though a bad one, may be for good and all taken, as shown at fig. 6 of the one drawing; but, as it requires a general representation of the machine, to be understood how it can be faithfully applied or used, in surveying all that belongs to the waters under the earth, as precipices, ravines, caves, &c., as well as the beds of seas and rivers, I have, in the other drawing, been as faithful to this end, as, at least, will serve for its theoretical delineation.

Fig. 1 is a side elevation of the machine in section.

Fig. 2 is a representation at the centre of the machine, seen from its stern.

Fig. 3 is a bird's eye view of the inside of the machine, with the top geering removed.

Fig. 4 is a governor, by which the machine is made to rise or fall in the sea, and made to remain at any desired depth below the surface, steady and constant.

Fig. 5 is a weapon for scuttling an enemy's ship; for the machine is likewise empowered to display a new species of fight in naval engagements; though, it is evident that the outline of fig. 6 will not answer the arrangement of the machine in the other fig. 8, yet it may serve to explain all that might be gathered from a representation of its simple exterior, which resembles a flat-bottomed boat, tapering to a sharp stem and stern.

The body or shell of the machine, as shown in the three sections, is double, having a water-space, W S, W S, &c., running right round its sides and bottom. In the bottom of the machine, in figs. 1 and 2, there are three shells or two spaces; the outside or narrowest space, C C C C, is the condenser of the steam-engines. The steam-engines are shown in figs. 1 and 2, at the bow end of the machine; *e c*, *e c*, of both engines, are the cylinders, and *a c*, between the two cylinders, is an air-pump, by which the furnaces of the steam-boiler, and the hands employed about the machine, are supplied with air. In fig. 1, S B, is the steam-boiler; F is the furnace; *f f f f*, are the flues; F P is the funnel-pipe, passing from the top of the flues to outside the boiler, and down, through the sides of the machine, at the bottom at the vent-holes, *v v*; S B and P P and *v v*, are the same in figs. 1, 2, and 3.

In fig. 1, S R is the stoker's room before the boiler; C A is the coal apartment; A L is an air-lock, into which the men enter to pass up to D A; D A, rooms where air at the common density is heated, and where the hands refresh themselves, after being, for a time, exposed outside the machine or otherwise, to excessive pressures of air, according to the depth they are under water. In fig. 3, L is the landing-floor, from which the men go out of, and come into the machine by the well, W; P is a passage from the landing, L, running to the engine-room by the boiler on each side, as at P P, in fig. 2.

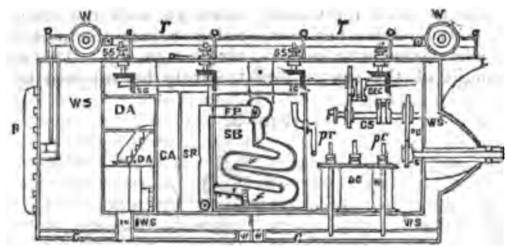
The air-cylinder, *a c*, fig. 3, draws the air from the surface of the water, down through pipes of malleable iron, such as A P; B J is a ball-joint, showing the manner the pipes should be coupled together; there is a leathern ring for a packing between the ball and socket, by which the joint is made perfectly water-tight; *a p j* is the joining of the pipes to the machine; *a p*, in fig, 3, is the air-passages from *a p j* to the air-cylinder. P, in fig. 3, is the locomotive propeller of the screw species; it derives motion from the crank shaft, C S, fig. 1, by the wheels, P G, and shaft, S; *p p p p* of fig. 3 aud fig. 1, are the force-pumps or air-pumps of the steam-engine; the steam is condensed by surface-condensation in the space, *c c c c*, and is drawn off by *p p p p*, or by three of them at least, and is forced by them back again into the boiler; the other pump, *p*, is required to compress the air into a small receiver, close by the landing, L, from which the men are supplied who descend below the machine; *p r*, *p r*, *p r*, of fig. 1, are the piston-rods of the engines and air-cylinder; *a c c*, fig. 1, is the air-cylinder crank, which gives motion to its piston. There is a shaft driven off the crank-shaft, C S, which runs along the top of the machine, as S G, S G, S G, S G, which gives motion to a number of vertical-spindles, *s s*, *s s*, *s s*, *s s*, and *s s* of fig. 2.

The instrument, fig. 5, is placed on the top of the spindles, *s s*, *s s*, &c., when the machine is to be engaged in battle; *c*, is the cutting, and *s*, the socket end of the instrument; *r r*, *r r*, is a railing round the top of the machine, and W W are two windlasses on fig. 1; R is the rudder of the machine.

Supposing the machine is to be employed for usefnl and quiet purposes, and is floating high out of the water on the surface, with the air-pipes coiled round into

small compass by the machine, or stretched on the water like a heavy cable (they being the same specific gravity of the water, nearly), a capillary funnel of a light temporary make, and of several pieces, is set on the top of the machine to give draught to the furnaces of the boiler, there being a suitable communication at C, between the top of the flues of the boiler, and the step of the funnel. Immediately on the steam being got up, the engines are put in motion, and the air-cylinder, *a c*, is re-

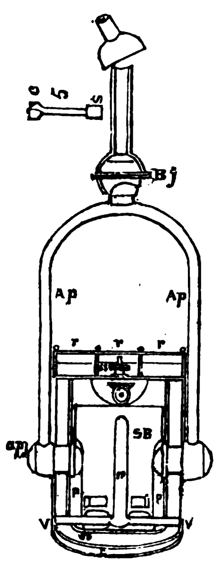
FIG. 1.



ceiving and discharging air from the air-pipes into the machine. This air has only one exit from the machine, which is through the furnaces of the boiler, down through the funnel-pipe, out at the vent-holes, *v v*, into the water.

Let the passage between the funnel on deck and the top of the flues be closed, the

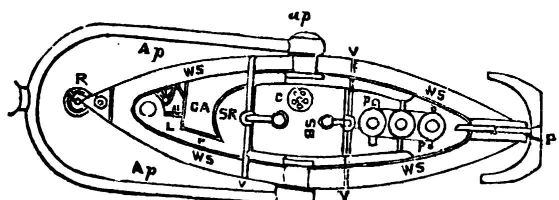
FIG. 2.



funnel removed, and all hands about the machine have taken their posts on the top and inside of the machine, the air will now be slightly compressed in every part of the machine, according as the machine is afloat higher or lower in the water, except in the rooms, D A, D A, where the air is always at the density of the common atmosphere, they being connected to the air-passage, *a p*, and closed from the atmosphere of the machine, except by the lock, A L; the air which is now discharged into the machine, is passing through the furnaces and out of the funnel-pipe, at the vent-holes, *v v*. If now we wish to descend, and are desirous to take an easy passage downwards, for the purpose, say, of examining any object we come across, and to shoot horizontally from one object to another, the space, W S, which surrounds the interior of the machine being, in the mean time, as the machine is afloat, almost filled with air, is, by means of the governor at fig. 4, made to fill with water, till the machine be immersed in the sea; the air escapes from the space by a valve wrought by the governor, into the air-passage, *a p*. But we will examine the nature and action of the governor first:—W S, at fig. 4, is the water space which surrounds the machine; there is a pipe, *m*, which passes up to the top of the space, open at both ends, which is a communicating passage between the space and inside of the machine; over the end of this pipe there is shown a slide valve, *v*, which likewise covers the end of the passage, *n*, leading from the valve, *v*, to the air-passage, *a p*. The valve, *v*, is connected to the end of the lever, L, by the link, *l*; *f c* is the fixed centre of the lever, L, at *c*, by its rod passing through a stuffing-box in the end of the cylinder. There are two ports, one at top and bottom of the cylinder; *w p*, the top port, is a passage out to the sea; and *a p*, the under port, is a passage to the air-passage, *a p*.

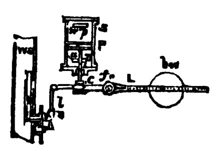
Now if the machine is to be sunk a fathom, or any depth, the weight, *b w*, on the lever, L, is placed towards the mark on the lever, which indicates the depth the machine is to be sunk to; the weight of the sea above the machine, or rather above the piston, P, in the cylinder, S, tends to depress the piston, it having only common atmosphere to resist the weight of the water on the under side; but now, if the weightiest end of the lever be heavier than the weight of the sea on the piston, the end of the lever to which the valve, *v*, is attached, will rise, and the valve, *v*, with it; but the moment the valve rises the smallest, it communicates the top of the water-space, W S, through the pipe, *m*, with the air-passage, *a p*, through the port, *n*; the air on top of the water-space, W S, will make instant way down through the pipe, *m*, through the valve, *v*, into the port, *n*, and away into air-passage, *a p*. This escape of air will instantly be supplied by the sea rushing

FIG. 3.



up into the water-space at the bottom of the machine, by the water-way, *w a*, which will instantly make the machine to descend. Now, as the machine sinks, there will be a continual increasing weight of water coming in upon the top of the piston, P, which will at length balance the weighted end of the lever to which the piston is attached, and the moment it does balance the weight, the lever will be restored to its original level, and the valve, *v*, to its former place. But, perhaps, ere the valve shuts off the communication between the pipes, *m* and *n*, and while the machine was but yet sinking to its depth, there too much water might have entered into the space, W S, which would, of course, cause the machine to be still going down; if so, and if it sinks but an inch below the depth corresponding to the place of the weight on the level, L, then will the pressure of the sea on the piston, P, be an overbalance for the weight, and the end of the lever to which the valve, *v*, is attached, will be depressed, causing the valve now to sink below the mouth of the pipe, *m*. The air now which is in the machine, having thus a free passage to the space, W S, by the pipe, *m*, and it being as much denser than the air in the top of the space, as the depth of water from the surface of the sea to the vent-holes, *v v*, is greater than the depth of water from the surface of the sea to the surface of the water in the space, W S, it will rush up the pipe, *m*, to the top of the space, W S, and will force the surplus water out again by the water-way, *w w*, at the bottom of the machine; therefore must the machine necessarily come to rest at any desired depth below the water; nor can it remain a moment steady, but at that depth which

FIG. 4.



corresponds to the distance the weight, *b w*, is from the centre of the lever, L. The propelling or horizontal locomotive powers of the machine, together with the means of steering through the deep, will be seen to be such as is usually employed. The machine is by the screw dragged, not pushed through the water, though, as a matter of no consequence which way it be employed, except that the rudder will be handier wrought as it is.

As this machine is cut out for two distinct purposes, I will endeavour to show how it can be employed to the destruction of a wooden armament, or the defence of a coast or river.

First. The machine is built of malleable iron, with two decks, about the common distance apart. The scuttling-spindles, *s s*, *s s*, *s s*, *s s*, to the amount of twenty or thirty, run flush with the topmost deck. Boring tools, such as is shown

by fig. 5, of various lengths, are in plenty between decks; they are adapted to cut either wood or copper.

Let the machine be attached to the bottom of a stout well-manned vessel, with a short length of air-pipes, which passes through the bottom of the vessel from which the machine receives her air; and suppose that now the machine is dragging along with the air-vessel the number of ships to be brought to the engagement, and is swimming high out of the water like another boat; when it has come within common range of the enemy, it sinks below the surface of the water, slow in its speed, and is secured to the bottom of its own ship by a simple fastening. This done, the machine again moves on, now dragging her consort as before, but guided in her course by the steering of the ship above, till they have manœuvred their course close to the enemy. The machine now lets go the windlass-grappling, which holds her to her own ship, and, spouting from under her hidings, gets under the bottom of the enemy's vessel. By the two windlasses, W W, and a simple grappling, the machine is brought to a steady bearing below the enemy; instantly the drills are clapped on the tops of the vertical spindles, and as each man gets ready, the spindles are thrown in geer. There is a back balance-weight now falls between decks, which raises the socket in which the drill is placed, and keeps the drill up to the bottom of the ship as it bores. Twenty or thirty of such tools would make more peace and quietness among the enemy in two minutes, than three hours' broadsiding could ever do.

Your opinion of all this may justly be very different; but if it be not altogether opposite to my own, perhaps you will favour me again through the "Mechanic and Chemist."

In figs. 1 and 3, the funnel-pipe, F P, is shown on the wrong side or end of the steam-boiler; it should be shown at the end next the steam-engines, but in the same manner of shape as it is represented.

I am, Sir,
Most respectfully yours,
MATTHEW SPROULE.

Why do fishes, when dead, float on the surface of the water with the belly uppermost? Because the body, being no longer balanced by the fins of the belly, the broad muscular back preponderates by its own gravity, and turns the belly uppermost; as lighter, from its being a cavity, and because it contains the swimming bladders, which continue to render it buoyant.—*White's Natural History.*

RAILWAY ACCIDENTS.

It is at the request of several of our correspondents that we return to this important subject. With regard to mechanical precautions and improvements, the best advice we can give to those of our readers who have devised plans for the greater security of railway travelling, and who are not disposed to pay the heavy penalty inflicted on genius by the patent laws, is to publish their inventions without reserve; for, by so doing, they will, at all events, secure to themselve the credit of their inventions, and stand a better chance of deriving pecuniary benefit from them, than they would do by making private communications to strangers, and, we are sorry to say, sometimes even to those who assume the title of *friends*. It often happens, that great men will not afford sufficient time for a careful examination of such projects; and little men are too often either incapable of appreciating the value of new ideas, or too eager for their own aggrandisement, to neglect any opportunity of advancement, even though it be at the expense of their honour. We make this distinction between great and little men because we consider no man worthy of being called great, if his talent, learning, or station, be not adorned with the still nobler qualities of probity and honour.

Although most of the recent railway accidents have been caused by gross neglect and mismanagement, and their recurrence might, in future, be prevented by the enforcement of proper regulations, we do not wish to discourage attempts at improvements in the construction of the machinery; but it must be allowed that, for the security of travellers, as well as for the credit of railway directions generally (we do not allude to any particular Company), the most urgent and indispensable reform, is the appointment of properly qualified persons in sufficient numbers to conduct the trains, and attend to every circumstance that requires especial precaution. This the railway directors know as well and better than the public; but they fear that such measures, fully carried out, might operate unfavourably on the balance sheet; and it is not surprising that a commercial company should esteem the amount of profit a consideration of paramount importance. The public require an efficient administration of every branch of railway service; and it is in their power to obtain it upon the same principle as biting a bull-dog's tail, to make him let go his hold—viz., by the

infliction of heavy deodands, and encouraging other modes of travelling till it is granted.

This law of deodand is of very ancient origin: it appears, that in the olden time, —deservedly called the age of darkness—all things or animals which caused the death of a human being, were forfeited *Deo dandum*, for a gift to God. The real object, however, was clearly to extort money; for though it was pretended that the deodand was to atone for the deceased being hurried out of the world without the prescribed religious ceremonies, it appears that things became deodand, when the sufferer survived a year after the accident. Lawyers of the present day are not so mercinary; there is not one to be found, higher than the Lord Chancellor, or lower than the petty-foggers that crawl about the police offices of London, that would be influenced by so mean a sentiment. The following extract from a correspondent of a morning paper, will be found interesting, especially to those who are called upon to act as jurymen at coroners' inquests:—

"DEODAND.—*(Deo dandum)*.—Is a thing given as it were to God, to appease his wrath, where a person comes to a violent death by mischance, and is forfeited to the King or grantee of the Crown. If to the King, his almoner disposes of it by sale, and the money arising therefrom he distributes to the poor. If forfeited to the Lord of the Liberty, it ought to be distributed in the same way.—3 *Inst.* 57, &c. &c. The original of Deodands is said to come from the notion of Purgatory; for when a person came to a sudden or untimely death, without having time to be *shrieved* by a priest, and to have extreme unction administered to him, the thing which had been the occasion of death became a deodand, that is, was given to the church to be distributed in charity, and to pray for the soul of such deceased person out of purgatory.—1 *Litt.* 443. There are several examples of forfeitures in cases of deodands, as if a man is driving a cart, so as the wheel runs over him, and presseth to death; the cart-wheel, cart, and horses, are forfeited to the Lord of the Liberty. For *omnia quæ movent ad mortem sunt Deodanda.—Bracton.* But it has been observed, that at the present day, if a man be killed by the wheel of a cart, drawn by horses, the Jury find that only *deodand* which was the immediate cause of death, viz.—the wheel, which is then seized by the Lord of the Manor, and converted to his own use.—1 *Nelson*, 639.

"If a man riding over a river is thrown off his horse by the violence of the water, and drowned, his horse is not deodand, for the death was caused per *cursum aquæ*.—2 Co. 483. Where one under fourteen years of age falls from a cart-horse, &c., they are not deodands; but if a horse kicks and kills such a person, it is deodand. 5 *Inst.* 57. And if a person wounded by any accident, as of a cart or horse, and die within a year and a day after, that which occasioned death is deodand; so that if a horse strikes a man, and afterwards the owner sells the horse, and the party striken dies of the injury, the horse, notwithstanding the sale, shall be forfeited as deodand.—*Plowd.* 260. If one falls out of a vessel, in salt water, the vessel is not deodand, as accidents at sea are frequent; but if one fall out of a vessel in fresh water, it is said to be otherwise.—*Wood's Inst.* 212. Things fixed to the freehold, as a bell hanging in a steeple, a wheel, or mill, &c., unless severed from the freehold, cannot be deodand.—2 *Inst.* 281. And there is no forfeiture of deodand till the matter is found of record by the Jury that finds the death, who ought also to find and appraise the deodand.—1 *Inst.* 144. After the Coroner's inquisition the Sheriff is answerable for the value, where the deodand belongs to the King, and he may levy the same on the town, &c.—1 *Hawkins.* A deodand is, in law, a forfeiture of anything or animal which occasions the death of a human being by mischance. Where the death is purely accidental, and no blame is attached to any person, the Coroner's Jury find a deodand of one shilling, or the like."

PREVENTION OF RAILWAY ACCIDENTS.

To the Editor of the Mechanic and Chemist.

SIR,—The writer has a plan to prevent the serious accidents which are constantly occurring upon railways. It is simple and effective; and, having a great regard for human life, would give it up to the public if they were poor; but, that part of the community being rather opulent, he, in justice to himself, thinks he should be rewarded for the trouble he has taken. The patent laws being so oppressive and expensive, he is not desirous of interfering with them. If any of the Railway Companies would adopt this improvement, which will be effective and expensive, it would prove advantageous to them, and secure the lives and limbs of both the passengers and the Company's servants employed upon the trains. As the writer is

a constant reader of the "Mechanic and Chemist," those who wish to embrace this opportunity, may signify their intentions through the medium of your publication, where it will meet his eye.

Yours, &c.

X. Y. Z.

[The information we gather from this communication is, that the patent laws form one serious impediment to mechanical improvements.—Ed.]

(From a correspondent of the "Railway Times.")

Suppose a luggage or passenger-train to meet with an accident by a carriage breaking down or getting off the rail, a stoppage of course ensues. Now, trains are so timed, as to follow twenty minutes or half-an-hour after each other, and I may be told, that the large lights at the *tail end* can be easily seen. This I deny; for these lights being so near the ground, they are very difficult to be observed from a distance, and where there is a curve or bridge, they cannot be *seen at all;* and, consequently, the driver of the next train gets so close, that before he has time to let off sufficient steam and put on the crew, his engine runs into the *stopped train.* If each driver, and also the person employed at the tail end of the train (whom I will call the guard), were furnished with three sky-rockets each, and on any stoppage taking place *from accident*, likely to detain the train, the driver of such train were immediately to let off a rocket, the drivers following would see these sudden lights in the air two or three miles off, and thereby have full time to come up quietly. In this way, too, a communication might be established along the line, or, at least, from station to station. It is well known that rockets can be made to produce various colours in their combustion—say red, white, or blue—and the drivers might be instructed to know, that a certain colour would indicate upon which rail the stoppage is.

SALT.

(Concluded from page 277.)

Salt was supposed by the ancients to be so detrimental to vegetation, that when a field was condemned to sterility, it was customary to sow it with salt. Modern agriculturists, however, consider it as a useful manure. The proportion of half-a-peck of salt to an area of soil equal to forty yards long by one broad, has been found to succeed. About twenty years since, Lord R. Manners applied salt in solution to the irrigation of herbage: one ounce of salt to a gallon of water was used with success; a stronger solution of two ounces to a gallon of water, was found to destroy the blades of grass; but, in the next season, an abundant crop of herbage came up. Dr. Holland recommends from eight to sixteen bushels of salt per acre. A mixture of salt and soot is a good manure; it is, indeed, the best compound, as a manure, into which salt enters as an ingredient. Corn is steeped in salt to prevent *smut.* In orchards, irrigation with a salt solution is recommended; and, strewed on the surface of the soil, it destroys slugs and snails in gardens; but it will also destroy vegetation, if dropped on the leaves of young growing plants. The use of salt as a manure is not confined to Europe: all the land on the coast is regularly treated with sea-water in China and Hindostan. It is to ferruginous sandy soil that salt is understood to be particularly adapted as a manure. Wood steeped in a solution of salt, so as to be thoroughly impregnated with it, is very difficult of combustion; and in Persia, it is supposed to prevent timber from the attacks of worms, for which purpose it is used in that country. Bruce informs us, that in Abyssinia it is used as money; and it is very probable that the pillars of fossil glass, in which the Abyssinians are said by Herodotus to have enclosed the bodies of their relations, were nothing but masses of rock salt, which is very common in that part of Africa. In manufactures, the uses of salt are very various. It enters into the composition of sal-ammoniac, of glass, of oxymuriate of lime, of corrosive sublimate, of Glauber's and Epsom salts, and of the painter's patent yellow; and if used in bleaching, in glazing earthenware, in assaying metals, in case-hardening steel, and in rendering iron malleable.

C. Davidson.

REVIEW.

The Pictorial Rhyming Lessons; The Alphabet Geometrically and Numerically arranged; Visible Exercises in Numbers. By F. Wilby, Master of the Pestalozzian Academy, Worship Square, London: Grombridge.

A very excellent set of cards, calculated to arrest the attention and call into exercise the thinking faculties of children. We think them likely to be highly beneficial to the child, as well as a pleasing auxiliary to the tutor.

MISCELLANEA.

The Great Liverpool Steamer.—This splendid vessel started from Falmouth on Wednesday, the 3rd instant, at thirty minutes past four P.M., on her second voyage to Malta and Alexandria. She takes out a heavy East India mail, and sixty-five passengers. Amongst other matters of interest connected with the departure of this vessel it may be mentioned, that she has on board a quantity of fruit trees, salmon, turbot, &c. &c., as a present from the Directors of the Peninsular and Oriental Steam Navigation Company, to his Highness Mehemet Ali, probably the first instance on record of the produce of the Tweed and Severn being sent to the shores of the Pharoahs, a distance of three thousand miles,

School for Railway Engine-drivers.—If any proof were wanting of the general ignorance of train conductors of the nature and responsibilities of their duties, the recent evidence taken before Coroners' Juries would afford an abundant supply. This being the fact, we are glad to know that a vigorous effort has at length been made, by the Directors of the Polytechnic Institution, to remedy this serious and growing evil. They have opened an institution at their establishment, under the management of a well-known professor and experienced engine-driver, where pupils may be properly qualified for their responsible duties. The plan adopted is to give a series of lectures, in which the nature and property of steam in its connexion with the steam-engine, as well as the whole of the construction of locomotive machines, are fully explained; and this is done with the aid of a most complete and extensive apparatus, consisting of working and sectional models, and other necessary adjuncts. We sincerely hope the railway companies will look to this matter, so deeply affecting their own interests and the safety of the travelling public.

Electrotype.—At a meeting of the Graphic Society held on Wednesday last, several impressions were exhibited of prints taken from electrotype plates, both of line and mezzotint, which defied even the most experienced judges to say which was the original or which the copy. There will be no necessity hereafter to print from worn-out plates, or to re-engrave them. A plate fresh from the engraver's hands, can now be multiplied if necessary, into a series of coppers—steel will no longer be of use. This will lower, not their value, but their price, and bring a new class of purchasers into the market.

The nearest of the fixed stars yet observed is supposed, on good grounds, to be not less than forty-one billions and forty thousands of miles distant.

Knives are said to have been first made in England, in 1568, by one Mathew, on Fleet Bridge, London.

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Thursday, December 23, Sheridan Knowles, Esq., on the Drama. At half-past eight.

Chemical and Philosophical Society, No. 241, High Street, Shoreditch.—Wednesday, December 28, Quarterly Meeting. At half-past eight.

Pestalozzian Academy, Worship Square.—Tuesday, December 22, Major Beniowski, on Mnemonics.

Bermondsey and Rotherhithe Literary and Scientific Institution, 4½, Church Street, Rotherhithe.—Monday, Dec. 21, Discussion. At half-past eight precisely.

QUERIES.

I have been in the habit of using a voltaic battery on Professor Daniel's principle, with a bladder to contain the zinc and salt and water; finding this very troublesome, I substituted for it the porous earthen pots, which are now so much in vogue; but my battery does not possess half the power that it did when bladder was used. Do the porous pots present a greater obstacle to the passage of the electric fluid than bladder? Perhaps of the number of your readers, some one may be able to answer that question.

W. H. W.

The best method for preparing an indellible ink, without the mordant, similar to that bearing the name of "Koud's." P. H. Y.

How may I try a sample of manganese by fire, so as to ascertain the quantity of oxygen gas it contains? 2. How to try a sample of the same with muriatic acid, stating the quantity of manganese and the quantity of acid for a sample? 3. Does a given quantity (say an ounce) of manganese give out the same quantity of oxygen gas by fire as an ounce of the same manganese gives chlorine gas with muriatic acid? if not, state the difference. A. S.

What the magnifying power of each of the glasses in the eye tube of a four-feet telescope ought to be to make the required magnifying power; and what the object-glass ought to magnify for the same? A. K. P.

TO CORRESPONDENTS.

C. J. K.—*There are four volumes, at 4s. 6d. each, up to Nov. 5, 1839; after which, to 4th of January, there would be thirteen Numbers.*

S. Walter.—*His plan of stopping a steam train suddenly, is impracticable. We refer him to an article on the subject in our last.*

T. S.—*Pictures in marble dust are executed by designing the figures with a strong varnish, and laying the powder of the required colour upon it. When they become faded, there is no known method of restoring them.*

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by DOUDNEY & SCRYMGOUR (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

THE
MECHANIC AND CHEMIST.
A MAGAZINE OF THE ARTS AND SCIENCES.

Nos. 126 & 127, NEW SERIES. | SATURDAY, DEC. 26, 1840. (PRICE TWOPENCE.) | Nos. 247 & 248, OLD SERIES.

ROLLING LAMP.

FIG. 1.

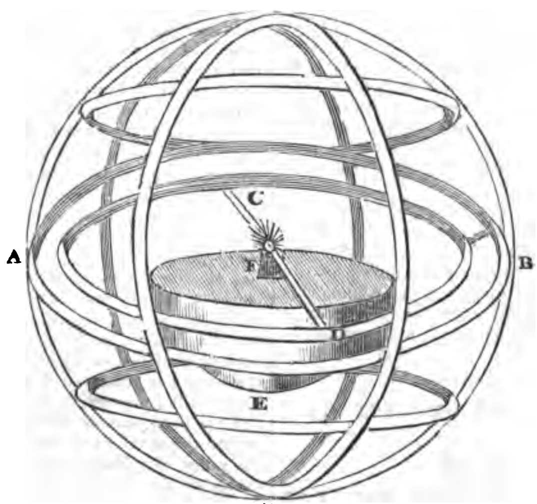
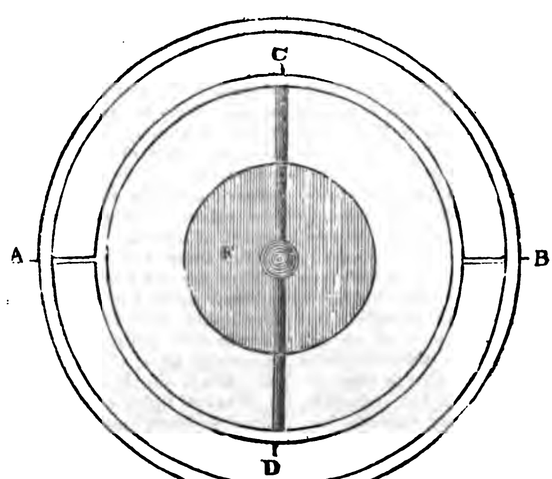


FIG. 2.



 City Press, 1, Long Lane: Doudney and Scrymgour.

ROLLING LAMP.

(See Engraving, front page.)

To the Editor of the Mechanic and Chemist.

SIR,—The following description of a rolling lamp will, I trust, be interesting to your readers, and the hint may be useful to those concerned in the manufacture of lamps. A C B H, fig. 1, is a hollow spherical frame or shell, which may be made of any pattern, provided it be perforated to allow the air to circulate, and the light to pass through. An internal circle is suspended, so as to move freely on the pivots, A B, and the lamp, F, is suspended in the centre, moving on the pivots, C D, at right angles to A B. The centre of gravity, E, is, in all positions of the frame, perpendicularly under the centre of the sphere; so that the whole apparatus may be rolled along the ground, or subjected to any other motion, without altering the upright position of lamp.

Fig. 2 shows the mode of suspension more clearly; and many useful applications of this principle in the simple form there exhibited, may be suggested by the ingenious. It is proper to state, that this lamp is not my own invention, neither is it new; but I believe it is not very generally known. Q. E. D.

SCIENCE WITHOUT MYSTERY.

No. II.

ON OPTICS AND THE PRESERVATION OF THE SIGHT.

IN all ages it has been a reproach to natural philosophers, that rather than confess their ignorance of anything in nature, they have invented false or suppositious theories; and they have so interwoven truth with error, that a student of ordinary judgment and talent is unable to distinguish the one from the other. The nature of light, and the manner in which it acts to produce vision, has been a theme for the exercise of much ingenuity, and has called forth many fanciful creations from modern as well as ancient philosophers. Des Cartes indulged so much in speculations of this kind, that he has written whole volumes on various branches of science, entirely made up of unfounded propositions, the emanations of an unbridled imagination. This writer's theory of vision is, however, entitled to some notice, as the same opinion is entertained by Huygens and Euler; they suppose that there is a subtile elastic medium which penetrates all bodies and fills all space; and that vibrations excited in this fluid by the luminous body, are propagated thence to the eye, and produce the sensation of vision, in the same manner that the vibrations of the air, striking against the ear, produce the sensation of sound. Professor Wood remarks, that it is objected to this hypothesis, and the objection has never been answered, that the vibrations of an elastic fluid are propagated in every direction, and to every corner to which the fluid extends; on the supposition, therefore, that light is nothing more than the effect of the vibrations of such a fluid, there could be no shadow or darkness. If it be said that the fluid by means of which vision is excited, is different from all other elastic fluids, the effect is ascribed to a cause, the nature of which is unknown; and the hypothesis amounts to nothing more than a confession, that we are ignorant in what manner vision is produced. The theory of undulations, which is now held in so much esteem, is little more than this old theory, with some pretended improvements. According to the Newtonian hypothesis, light consists of very small particles of matter, which are constantly thrown off from luminous bodies, and which produce the sensation of vision by actual impact upon the proper organ. In favour of this hypothesis it is observed, that the motion of light is conformable to the laws which regulate the motions of small bodies under the same circumstances. Thus, where it meets with no impediment, it moves uniformly forward in right lines; and, in its incidence upon reflecting surfaces, the direction of its motion is changed as it would be, did it consist of small particles of matter. But however plausible this hypothesis may appear, it must be recollected that it is only suppositious, and, therefore, inadmissible as the foundation of any theory. In rejecting all speculative hypotheses, we do not contract the limits of pure optical science; for those properties of light which are discovered by experiment, are sufficient to explain all the principal phenomena which are the object of optics. Leaving, therefore, in doubt those mysteries of nature, which philosophy has not yet unveiled, we will proceed upon the sure ground of known and indisputable facts, to explain the laws of reflection and refraction, which are the principles upon which the whole doctrine of optics is founded.

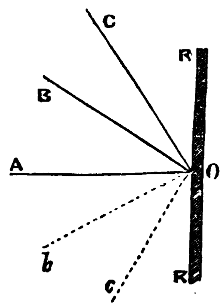
A ray of light, while it continues in the same uniform medium, proceeds in a straight line; for objects cannot be seen through bent tubes; and the shadows of

bodies are terminated by straight lines. Also the conclusions, drawn from calculations made on this supposition, are found by experiment to be true.

When a ray of light, incident upon any surface, is turned back into the medium in which it was moving, it is said to be *reflected*. Bodies which light cannot penetrate, are called *opaque*, and those through which it passes are called *transparent*.

In meeting an opaque body, it happens to rays of light, as it would happen to an impinging elastic body; that is to say, it

Fig. 1.



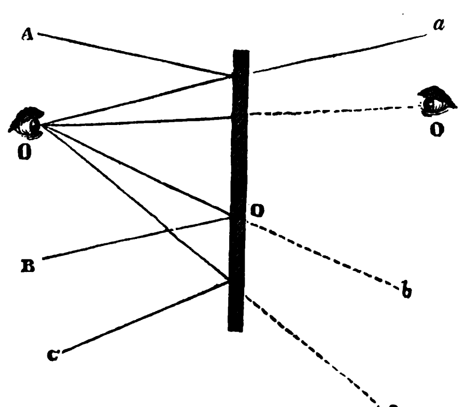
rebounds, or is reflected back at an angle equal to that which it formed in meeting the obstacle. This general law is expressed by saying, that *the angle of incidence is equal to the angle of reflection.*

Let B O be a ray of light incident on the reflecting surface, R R, at O; it will be reflected in the direction O *b*, making the angle B O A, equal to the angle A O *b*, A O being perpendicular to R R. The ray, C O, which arrives more obliquely at the same point, O, will be reflected in the direction O *c*, making the angle, C O A, equal to the angle A O *c*. If A O represent a ray falling perpendicularly upon O, it will be reflected back upon itself in the direction O A. It is one of the incomprehensible properties of light, that rays will pass each other in every direction, without any perceptible impediment to each other; for rays proceed from every visible point in the universe to every other point, and, in their progress, pass freely through torrents of light issuing, in all directions, from different suns, and different systems.

Opaque bodies are either bright or dead, according as they reflect rays of light more or less perfectly. In very brilliant bodies, the reflection is so perfect, that we cannot see the bodies themselves, but only the bodies which send them their rays; thus, in highly-polished mirrors, the reflecting surface becomes invisible, and we only see the surrounding objects as if pourtrayed upon it.

The eye, fig. 2, which looks at a mir-

Fig. 2.



ror, sees only the images, *a b c*, of the bodies, A B C, placed at different angles, and they are seen beyond the mirror, in the directions of their reflected rays, and at the apparent distance behind the mirror, equal to the real distance of the objects from their points of incidence; but *a* is seen at the right of *b*, and *c* at the left; which is the reverse of the real position of the objects.

If all bodies were perfectly smooth and bright, we should see only the reflections of the luminous body, which is the first source of light; but as most bodies, owing to the roughness and unevenness of their surfaces, disperse or arrest the rays which

they receive, we perceive their own forms, colours, and appearances.

It must be observed, that the angle contained between the incident ray and the perpendicular to the reflecting surface at the point of incidence, is called the *angle of incidence*. B O A, fig. 1, is the angle of incidence of the ray, B O.

The angle contained between the reflected ray and the perpendicular to the reflecting surface at the point of incidence, is called the *angle of reflection*. A O *b* is the angle of reflection of the ray B O.

The angle contained between the incident and the reflected ray, is called the *angle of deviation*. B O *b* is the angle of deviation of the ray, B O.

Q. E. D.

(To be continued.)

ACCIDENTS ON RAILWAYS.

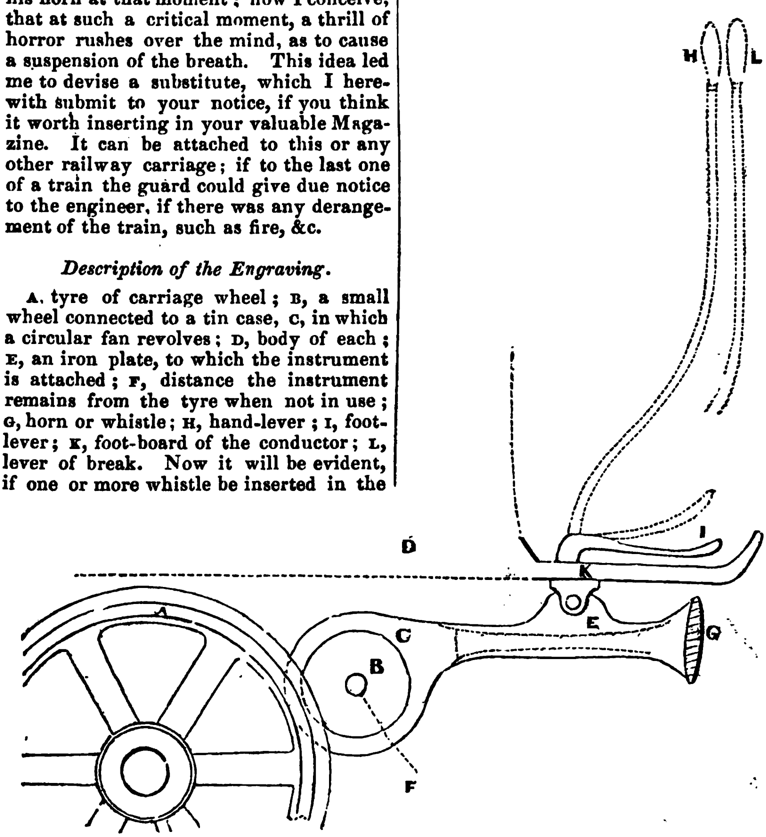
To the Editor of the Mechanic and Chemist.

SIR,—One out of the numerous accidents that of late have occurred, attracted my attention—viz.., that on the London and Blackwall Railway. On the coroner's inquest, it was there stated by one of the conductors, that he was unable to blow his horn at that moment; now I conceive, that at such a critical moment, a thrill of horror rushes over the mind, as to cause a suspension of the breath. This idea led me to devise a substitute, which I herewith submit to your notice, if you think it worth inserting in your valuable Magazine. It can be attached to this or any other railway carriage; if to the last one of a train the guard could give due notice to the engineer, if there was any derangement of the train, such as fire, &c.

Description of the Engraving.

A, tyre of carriage wheel; B, a small wheel connected to a tin case, C, in which a circular fan revolves; D, body of each; E, an iron plate, to which the instrument is attached; F, distance the instrument remains from the tyre when not in use; G, horn or whistle; H, hand-lever; I, foot-lever; K, foot-board of the conductor; L, lever of break. Now it will be evident, if one or more whistle be inserted in the tube or horn, or a large poppet, and the circular fan raised, so as the wheel, B, touch the tyre, an instantaneous blast will be produced, which will be heard at a very considerable distance; and, I apprehend, this will entirely obviate the like occurrence again.

E. G. HITCHINGS.



A VISIT TO A POT MANUFACTORY.

No. IV.

Some articles are coloured in square or oblong patches; flower-pots are often coloured in this way. This effect is thus produced:—The articles are first fluted or chequered, or figures are made on it with the runner—an instrument previously mentioned. These fluted or figured parts are next covered with a band of slip; the article is then removed from the chuck, and placed to dry. When sufficiently dried, the article is placed upon the chuck again; the turner applies his cutting tool to the coloured part, and the tool, catching only the elevated parts, leaves the colour in all the depressions, thereby producing the effect above mentioned.

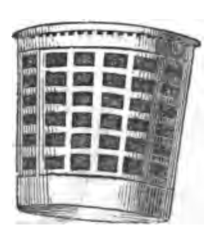
The slips used by the coloured-ware turner are black, white, red, drab, and a few others. White slip is the cuttings of the earthenware turner dissolved in water. Drab and red are made of different kinds of marl. Black is composed of burnt ironstone, mixed with brown slip; brown slip is a compound of red marl and ironstone; blue slip is often used.

As the turning of lustre is the same, in many respects, as that of earthenware, we will only notice the colouring of the articles by the turner. Previous to lustreware being turned, the inside is made white by pouring in and out a quantity of white slip: a crust of slip adheres to the article. The articles are coloured on the outside by blowing from the blowing-bottle (previously mentioned) bands of slip round them. A band is made sometimes round articles of lustreware with different colours, so as to resemble marble; this is called porphyryware, and is thus manufactured:—The article is turned and smoothed, and a band, varying in size from an inch to three or four inches, according to the size of the article, is made round it with white slip. This band is covered by the lathe-treader with a mixture of little bits of blue, yellow, drab, brown, and white clay. These little bits of clay are obtained by hardening large pieces of the substance, pounding them, and passing the pounded clay through sieves of different degrees of fineness, to separate the large lumps and the dust. The article is then set away to dry. When it has become hard enough, the part upon which the mixture is put is dipped in water, and the article being placed upon the chuck again, the workman applies a flat tool, with a gentle pressure, to the porphried part; by this means it is made smooth and level with the rest of the article. It is again placed to dry, and is finally finished, by being smoothed and polished in the same way as earthenware. This kind of pottery, when well manufactured, looks very beautiful. Some articles have a band of white grotto-work round them, made with little bits of white clay.

The operations of the black-ware turner are similar to those of the turner of earthenware, except that black ware is polished with a hare's foot; earthenware, with a smooth flat-iron tool. The object of this is, black, when finely smoothed and polished, will not take the glaze. In the turning of lustre and coloured ware, those parts that have to be coloured—that is, covered with slip, are not previously polished.

We will now notice the operations of the chinaware-turner. China, while in the clay state, is very tender, and, therefore, requires to be operated upon with great care. A person who has not been used to turning china, when he comes to work in that sort of pottery, will break a great many pieces of ware during the first three or four days, if he be not very careful. China cups and basins, previous to being turned, are straightened by inserting into them a block made of plaster of Paris. The person who performs this operation is called the blocker. The chinaware turner's tools differ from the other turners' tools; for, in addition to the end being turned up about half-an-inch, the edge of the tool is turned up about one-eighth of an inch. The tops of articles of china are not rounded in the same way as those of earthenware. After the article is turned, it is cut off square at the top, and, another sort of chuck being screwed on the lathe, the article is put on it, and the top rounded with a turning tool. Chinaware is not polished. The

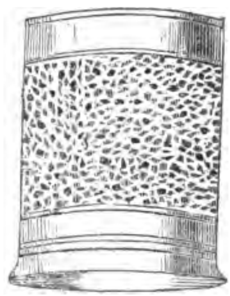
Fig. 1.



turner has nothing to do with the scolloping of articles of china. The scollops are made with a knife, by a person (generally a woman) called the scolloper. The clay

of which china-turned mugs are made, contains a little common clay. They are, therefore, not so tender as cups and basins. The turning of them is similar to that of earthenware mugs.

FIG. 2.



Cups and basins are sometimes made in a mould by the thrower. The article is first made in the same way as the common ones; it is then put into a mould and pressed close to it: it is then dried a little, after which the inside is polished; when sufficiently dried, it is taken out of the mould. These are called pressed-ware, and require turning only at the foot.

Fig. 1, a piece of fluted or checquered-coloured ware.

Fig. 2, porphyry ware.

Figs. 3, blocks used in straightening chinaware.

FIG. 3.

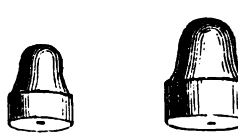
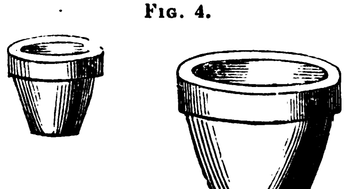


Fig. 4, moulds used by the thrower in making pressed ware.

FIG. 4.



In our next we will fix the handles, spouts, &c , to the articles—the operations of the handler.

PERKINS'S PATENT APPARATUS FOR TRANSMITTING HEAT BY CIRCULATING WATER.

ONE of the most important applications of this invention, is heating the water in a steam-boiler; the boiler is placed horizontally over the furnace, and the sides of the boiler and furnace are surrounded by a double casing of iron, containing water or some slow conductor of heat. Those parts of the boiler and casing which are in close proximity with the furnace and flue, are protected from the action of the fire by a lining of fire-clay or bricks. The boiler consists of a vessel in the form of a parallelogram, having a perpendicular elongation of one-fourth the length of the boiler, which I shall call the water-box. The boiler is strongly braced by ties in every part, and thus rendered secure against internal pressure. It is to be furnished with safety valves, water-guages, and the other usual appendages of steam-boilers, being, in these respects, similar to the boilers ordinarily employed.

In a marine steam-boiler of sufficient capacity to evaporate fifteen cubic feet of water per hour, a series of wrought-iron tubes are employed, one inch in external, and half-an-inch internal diameter. These tubes, which form the chief object of the patent, are denominated, by the inventer, " circulating or transmitting tubes;" their use is to convey or transmit the heat from the fire in the furnace to the water in the boiler, by means of the circulation of the water contained within them, which water is entirely separated from, and independent of, that to be evaporated in the boiler. To effect this object, a portion of the tubes is employed to abstract the heat from the fire, and is disposed in and about the furnace and flue in such manner as most fully to accomplish the desired end, while another portion of the tubes is placed within the vessel containing the fluid to be heated, and imparts to the fluid the heat previously acquired in the furnace. The tubes are sixteen in number, and are arranged horizontally and parallel to each other, at the distance of one inch apart. Near the bottom of the water-box they enter that part of the flue which is most distant from the fire, and after rising in a serpentine direction, they pass under the fire, and, returning from the fire-bars of the grate upon which the fire rests, then again returning, they pass over the fire at its hottest point, and, emerging from the furnace, enter the boiler a few inches below the water line; then passing through the horizontal portion of the

boiler, they bend and descend through the water-box, and join their other respective ends in the flue. They are joined to a cross pipe, called the feed-pipe, the use of which is to distribute the water equally in all the tubes, thus avoiding the trouble and delay of filling each tube separately. Except at their junction with the feed-pipe, the several tubes have no connexion or communication with each other, but each maintains a circulation throughout its entire length independently of the rest. The length of each tube is fifty feet, and the total length of all the tubes is about 800 feet, being equal to a superficial surface of about 200 square feet; of which one-fourth part is within the boiler, and the other three-fourths in the furnace and flue. The ends of the tubes are joined to each other by sockets, with right and left hand screws, and the joints thus made, are capable of resisting the pressure which the tubes themselves will bear. The passage of the tubes through the boiler-plate is rendered tight and secure by means of flange nuts screwed upon the tubes, and closely embracing each side of the boiler-plate. There is a small force-pump for supplying any deficiency of water that may occur within the tubes from leakage, that being the only manner in which loss can ever take place, in consequence of the tubes being completely closed in all parts. The water in the tubes, when heated, undergoes considerable expansion, or increase in bulk. To prevent any undue pressure which such expansion would occasion within the tubes, a valve is applied, loaded at a pressure somewhat above that which is consequent upon the temperature at which the tubes are worked, but far below that which the tubes are previously proved to be capable of sustaining; no water, therefore, is ever permitted to escape from this valve, but that which is ejected by the increased pressure arising from the expansion before mentioned.

In cases where the boiler is allowed to cool periodically, the tubes are to be supplied with water by a self-acting apparatus. A cistern, the capacity of which is proportioned to the size of the apparatus, communicates with the safety valve, and also with a supply-valve, opening inwards towards the feed-pipe.

The apparatus having been filled with water when cold, the heat of the fire will expand the water within the tubes, and create a pressure sufficient to open the external valve, and allow the excess of water to flow out into the cistern. When the tubes have arrived at their maximum temperature, the water will undergo no farther expansion, and the external valve will close. No more water will then escape, unless the tubes are sufficiently over heated to open the valve by the internal pressure. When the apparatus is allowed to cool, the water will contract to its original bulk, and a vacancy or vacuum will take place within the tubes equal in extent to the amount of water previously ejected by expansion, added to that which may have escaped by leakage at the joints; which vacancy will be immediately filled by water from the cistern, through the passage of the internal valve and the feed-pipe. The return of the water to the cistern when under pressure, is prevented by the closing of the internal valve.

The circulation of hot water, which takes place in each of the foregoing applications of hot-water tubes, arises from a well-known principle, and is similar to that which takes place in the apparatus for warming buildings before alluded to, and which has been made the subject of a previous patent. That portion of water contained in the tubes which are exposed to the action of the fire, acquires an increase of temperature; and its specific gravity being thereby lessened, it ascends by its superior levity, while that portion which is employed to transmit the heat thus acquired, to the water or other fluid, acquires increased density, as it parts with its heat and descends, by its superior gravity, to take the place of the lighter or ascending current.

It is desirable in all cases so to arrange the tubes within the boiler, generator, or other vessel, as to cause the hot-water current to flow downwards through the surrounding fluid, and impart its excess of heat, as far as practicable, to the upper surface of the fluid. In vessels of great height and small lateral capacity, the hot-water current, by descending through water of constantly decreasing temperature, will part with the whole of its heat, and leave the bottom of such vessel at a temperature little higher than that of the water, by which the vessel is supplied. This entire transmission or transference of heat, however, cannot take place, except in those cases where the lower extremity of the vessel is constantly supplied with cold water, to make good the deficiency occasioned by evaporation at the surface; and, consequently, when the water or other fluid is intended to remain for a long time stationary or unchanged, so that the whole mass will become equally heated, little benefit can result from the

downward current. Another advantage attending such an arrangement is, that in steam-generators of small capacity, no priming or overflow of water will ever occur, however hot the tubes may be.

It is also desirable to reduce as low as possible the temperature of the smoke and heated air, before allowing it to enter the chimney, by causing it to pass in an opposite direction to that of the hot-water current; so that, after leaving the fire, it may at first come in contact with the highly-heated tubes, and, lastly, with the colder tubes near the bottom of the apparatus. It is by due attention to this facility which this apparatus affords of reducing the temperature, both of the descending hot-water current, and the smoke and heated air to a point much below that of the steam, or of the upper part of the water or fluid, that one of its advantages is realized.

SHORE'S PATENT PROCESS OF PRESERVING AND COVERING IRON AND OTHER METALS.

(Abstract of Specification.)

My invention relates to a mode of obtaining or applying a permanent covering of copper or of nickel, by means of galvanic batteries, on articles manufactured of wrought or cast iron, tin, lead, and copper, and of alloys of such metals—such covering acting as a preservative to some of those metals and alloys of metals, and, in other cases, as a superior surface. And, in order to give the best information in my power, I will proceed to describe the means pursued by me in carrying out the invention; first remarking, that I am aware that the employment of the galvanic battery, to deposit copper on to a metallic surface, in order to obtain copies of coins, medals, and engraved designs, has been practised by many persons: and I have mentioned such process, in order to state that I make no claim thereto; my object being to obtain a permanent covering of copper or of nickel on to manufactured articles of the metals and alloys of metals herein mentioned, in order that such covering may act as a preservative external surface to such of the metals as require it, and principally as a superior surface in other cases, when the commoner or baser metal, tin, lead, or copper, forms the receiver of the permanent covering. The mode of depositing copper by means of the galvanic battery, when employed for obtaining copies of medals, coins, or engraved surfaces, being now well understood, it will not be necessary to enter into a particular description thereof in this my specification, farther than will enable a manufacturer readily to apply such process in carrying out my invention, in order to obtain a permanent covering on articles manufactured from the metals or alloys of metals above mentioned. I take an open vessel of a size depending on the article or articles to be operated on at one time; such vessel I prefer to be of wood or of earthenware, and I divide this vessel into two compartments, by a partition of unglazed earthenware or other porous substance; into one of the compartments I put pure water slightly acidulated, by preference with sulphuric acid or other material usually employed to obtain galvanic action, as is well understood; and into the other compartment I put a solution of a salt of copper, by preference sulphate of copper or nitrate of nickel, whichever is to be used as the covering metal. And I find in practice, that solutions of the metals act best when they are kept up to a neutral strength. Into the first compartment I immerse a piece of metallic zinc, or other suitable metal easily acted on by the solution, as is well understood; and to such piece of metal there is affixed a wire, by preference, of copper; this wire is bent over the partition, so as to enter into the solution in the second compartment of the vessel; and the manufactured article to be covered, is then to be placed in the second compartment, and the wire caused to be kept in constant contact therewith, taking care that the article under process is moved from time to time, to prevent any part or parts being left uncovered.

And it is important to observe, that the manufactured articles to be coated are well cleansed, in order that the action of the galvanic process thereon, may produce a perfect deposit or coating to the surfaces of the articles under operation; and for this purpose I prefer to employ heat, where the metal to be covered will allow of being raised to a low red heat, though the other known means of obtaining clean surfaces to such, and the other metals and alloys of metals herein mentioned, may be employed. When I employ heat, I prefer to place the metal articles into a crucible, covering them with sand, charcoal, black-lead, or other suitable powdered substance, and then raising the crucible and its contents to a low red heat in an open furnace, and then permitting the same to cool; when, on the manufactured metal articles being removed, they will be found in a good condition for

the process; the workman having first removed any sand or other substance therefrom, which may be found to adhere. It should be stated, that the solutions employed may be either hot or cold. The time which articles are to be kept under operation, depends on the extent or thickness of covering it is desired to be obtained; the longer the articles are under operation, the thicker the covering. In covering large articles, it will be found convenient to do each separately; but in covering small articles, such as iron nails, then I employ an open frame or basket of wire in connexion with the wire, affixed to the piece of metal in the first compartment of the vessel, such frame or basket allowing the small articles to be readily kept separate, and turned, by shaking up or otherwise.

ANTISEPTIC PROPERTY OF ACETATE OF ALUMINA.

On Tuesday last the body of a man, named George Berry, who died in the Westminster Bridewell in 1838, of epilepsy, was opened at the Windmill Street Theatre of Anatomy, in presence of Mr. T. Duncombe, M.P., Mr. Wakley, M.P., and a great number of gentlemen belonging to the medical profession. Four days after the death of the individual, a fluid of an antiseptic character was injected into the body by one of the carotid arteries. The corpse was then bound round with bandages, placed in a coffin, and kept in a room of varied temperature until Tuesday last, without being meddled with. The body having been lifted out of the coffin, was stripped of its bandages; the flesh was wonderfully firm, especially so were the muscular portions—the thews and sinews; the viscera was likewise in a remarkably perfect state, though discoloured, being of a clay colour. No effluvia was emitted, if we except that of camphor, which was rendered more disagreeable by the action of the fire, in a large cast-iron stove, which was close to the body. Certificates of the period of death, of the injecting process, and so forth, contained in a bottle beside the deceased, were exhibited; so that there could be no doubt of the fact. The dissection was carried on with the utmost fairness, and the result, as far as we could judge, gave satisfaction. Many of the details, of course, were only fit for the pages of a medical journal, and are here necessarily passed over.

In order that the origin of this discovery may be the better understood, it is proper to state, that in the year 1835, the French Academy of Medicine appointed a commission, consisting of five of its most distinguished members, to institute an inquiry into the subject. In 1837, this commission made a definitive report, in which it is stated, that during the preceding two years M. Gannal had been incessantly occupied upon a series of experiments, with a view to ascertain the best mode of preserving animal substances, and that he had at length succeeded in discovering a fluid, by the antiseptic properties of which, the remains of deceased persons might, by the simple and delicate process of injection by one of the arteries, be preserved for a considerable length of time, without any material change of feature or discolouration of countenance. After detailing a variety of experiments observed by the commission, and all of which had been attended with complete success, they gave it as their unanimous opinion, that M. Gannal had rendered important service to science and humanity; and they farther recommended that their report should be forwarded to the Minister of Public Instruction, directing his attention to a discovery capable of being applied to so many useful purposes; and likewise to the Minister of Commerce and Public Works, as a means whereby the public health might be placed on a surer foundation. The importance of the subject, and the interest attached to it, induced us to enter fully into its details. In no country, it is believed, is more decent and rational respect paid to the observance of every ceremony which concerns the remains of a deceased relative or friend, than in England; seeing that in no country the feeling of tender regard to the memory of the departed is more affectionately cherished. And if this has hitherto been the characteristic of Englishmen, it will be acknowledged that it is especially so at the present moment, when, in consequence of the increased population of the country, and the consequent crowded condition of the receptacles till now appropriated to the dead, cemeteries are in progress of being built, not only in the environs of this great Metropolis, but of most of the large cities and towns of the United Kingdom. At such a moment, and under such circumstances, it can be little doubted that a determination on the part of the proprietor of the "Gannal process," to introduce into this country, with regard to interments, that recently-discovered process, by means of which, the remains of the deceased can be preserved for a considerable time without material change in appear-

ance, and without inconvenience or danger to the living, will meet with the same favourable reception in England which has attended its establishment in France. Encouragement to this step has been induced by the numerous instances of extreme distress occasioned to relatives and friends by the early appearances of decay; and from conviction that such distress will be greatly alleviated by means of the discovery. It is conceived, also, that where the place of sepulture is situated at a distance, or where the members of a family happen to be absent, it must be a source of great satisfaction to know, that a process is ready for application on the instant, and at a moderate expense, which will preserve the body for an unlimited period from incipient decay, without alteration in its appearance, or the presence of the slightest effluvia—which arrests putrescency and the liability to cause contagion—which occupies but a short space of time in the performance, and is unattended with any distressing exposure or disfigurement of the person—which may, when desirable, be performed in the presence of the nearest friends of the deceased, without giving pain to minds of the most delicate sensibility; and, by the application of which, the usual but very revolting mode of preserving the remains of the dead by embalming, will be superseded. The discovery is designated "the Gannal process," from the name of the eminent chemist and natural philosopher by whom it was first made in 1826, and who, after fourteen years of unwearied skill and labour, has at length succeeded in bringing it to perfection. Beside the body of George Berry, lay that of an infant, who died eighteen months ago; many specimens also in natural history, preserved by the process we have described, were shown, all of which were considered by the scientific persons present, to be remarkably well preserved. The fluid, for there was no secret about the matter, is the acetate of alumina.

CHARCOAL.

Charcoal is the impure carbon obtained by the decomposition of vegetable matter by heat, without free access of air. It is prepared for the common purposes of fuel in the following manner:—Small pieces of wood, about twelve inches in length, and about one or two inches in thickness, are laid alternately, two one way, then two across, leaving a channel of five or six inches in the centre. This is called the chimney to the kiln. The wood is previously prepared in logs of about two feet in length: the large pieces are split into two or four.

When the chimney has been carried to the height of two feet, it is closed in on all sides with the prepared logs, placing the largest next to the chimney. It is thus raised successively two feet at a time, until it has reached the height of eight or nine feet, making the diameter at the base about twelve or thirteen feet; it is then cased with sods or earth, about six inches in thickness, and the kiln set on fire, by throwing some lighted chips down the chimney.

The sods or earth are first laid towards the summit, with a thin coating; then thickened, and, finally, when the wood appears sufficiently lighted, by flames issuing from the aperture, the chimney is stopped by a large sod on the top.

Great care is now required, that the smoke should issue in a moderate degree, and, generally, through the coating of earth, by placing a small plastering of mud over such crevices when it may burn too fast, or making small holes in the coating when not burning sufficiently equal with the rest. To effect this, it must be constantly watched, day and night. It may be ascertained if burnt enough, by taking several pieces from the outer side at various parts, and breaking them in two, to see if the interior part of the log is burnt equally with the exterior. It should break easily.

For the preparation of the finer kinds of charcoal, fit for medicinal use, the following process is employed:—The wood to be charred is put into a large cast-iron cylinder, fixed in masonry over a grate. This cylinder terminates at one end in a curved pipe, and the other end is furnished with a door, which is accurately closed after the wood is introduced. A fire is next lighted in the grate, and the water, empyreumatic acid, and volatile parts of the wood, are driven off through the curved tube by the heat, which is increased until the contents of the cylinder become red hot. The fire is then withdrawn, the cylinder is allowed to cool, and a black, shining, pure charcoal is thus obtained.* Ivory and bone shavings, treated in the same manner, make the preparation termed *ivory black*.

For internal use, however, it is, per-

* This process was invented by Bishop Watson for the use of the gunpowder manufacturers, who require a very pure charcoal.—*Aikin's Chem. Dict.* Art.—*Carbon*.

haps, necessary to have wood charcoal still purer; and, to effect this, the process of M. Lowitz is to be preferred. The charcoal is to be reduced to fine powder, and put into a crucible (so as to fill it), on which a pierced cover must be luted. This vessel is then to be heated red hot, and kept so, as long as a blue flame appears to issue from the hole in the cover; and when this stops, it is to be taken from the fire, cooled in a dry place, and the charcoal instantly put into well-stopped bottles for use. Vide "Crell's Chem. Journal," vol. ii., page 270.

In whatever manner prepared, the purest charcoal contains, generally, about one-fiftieth of its weight of earths, salts, or metallic matters; its other constituents are, according to Dobereiner, 68.4 of carbon, with 1.5 of hydrogen, and a minute portion of oxygen. The salts and earthy matters can be separated by boiling the charcoal with diluted muriatic acid in excess; then washing the charcoal on a filter with boiling water, until the fluid passes free from acid, and throws down no precipitate with oxalate of ammonia. The powder is finally to be dried in a stove.

Pure charcoal is inodorous and insipid, black, shining, and brittle. It is a good conductor of electricity. Its specific gravity is about 3.5. When newly prepared, it absorbs air, gases, moisture from the atmosphere, and liquids, so as to increase its weight from ten to eighteen per cent., according to the kind of wood from which it is made. From the experiments of Allen and Pepys, charcoal from fir gained 13 per cent.; from box, 14; from beech, 16.3; from oak, 16.5; from mahogany, 18.

Although charcoal is insoluble in water and every other fluid, there is, nevertheless, a quack preparation for cleaning the teeth, sold under the name of "Concentrated Solution of Charcoal."

Charcoal is easily pulverized. When excluded from air, it is not affected by the highest degree of heat. When pure and well washed, so as to destroy all the earths and salts, it corrects the fetid odour of putrefying animal and vegetable substances, and destroys the odour, taste, and colour of some, particularly of mucilages and oil, and matters in which extractive properties abound. Thus, common vinegar becomes colourless when it is boiled in pure charcoal powder; water, which has become fetid at sea, is purified by filtering it through charcoal; that intended for long voyages may be preserved perfectly pure, by thoroughly charring the insides of the casks.

Charcoal has been given internally to correct the putrid eructations of some kinds of dyspepsia; but, in order that it may produce this effect, it should either be newly prepared, or such as has been preserved in well-stopped bottles. It is probable that it operates both by correcting the fetor, and absorbing the gas generated in the stomach, as well as checking the decomposition of the undigested aliment. Dr. Calcagno, an Italian physician, proposed to employ it instead of cinchona bark in intermittents; but this suggestion has not been supported by British practitioners. It has been applied advantageously, mixed up in powder, with boiled bread or linseed meal and water, as a poultice, to foul ulcers and gangrenous sores; and it is, undoubtedly, in combination with powdered catechu, kino, or rhatany root, the best tooth-powder known. It may be used, also, as a test for arsenic. Farther information may be obtained by consulting Dumas, Traité de Chimie, tome I, p. 558; also Phil. Mag., vol. 3, where is an interesting paper by M. Mushet.

DESCRIPTION OF THE MINES OF SEMNITZ.

By six o'clock in the morning we were all astir, and, armed with a change of clothes for me, we sallied forth to the accountant's office, where we were to be furnished with mining dresses for the gentlemen, and our guides with lamps for our underground journey. Away we went, however, and ere we had taken a hundred steps we were in utter darkness. We were moving along a passage, not blasted, but hewn in the rock, dripping with moisture, and occasionally so low as to compel us to bend our heads to allow us to pass; while beneath our feet rushed a stream of water which had overflowed the channel prepared for it, and flooded the solitary plank upon which we walked. But this was of little consequence, for the large drops that exuded from the roof and sides of the gallery, soon placed us beyond the reach of annoyance from wet feet, by reducing us to one mass of moisture. When we arrived, heated and panting, at the bottom of the first hemisphere, the chief miner led the way through an exhausted gallery, which yawned dark, and cold, and silent, like the entrance to the world of graves. * * * To the right of this gallery opened another vast cavern, cumbered with large masses of rock, but of which we could see the whole extent. Hence we passed through another gallery similar to the first, except that it had been produced

by blasting. * * * There was, moreover, something awful in the reflection, that the subterranean passages which branched off right and left, and which were clearly seen amid the darkness, extended for upwards of fifty miles, each mine throughout the range being accessible from that last traversed. The very echoes which swept away, and died, at last, in low whisperings afar off, added to the feeling; while the chill produced by our soaked and clinging garments, warned us not to linger too long amid the clammy draughts in inaction, but to move on from point to point without delay. * * * Another set of ladders, as steep and as sticky as the last, admitted us to the second hemisphere. When we were fairly gathered together in this gloomy cavern, and our guides raised their lamps and moved them rapidly along the roof and sides of the chasm, it was beautiful to see the bright particles of silver flash back the light. Having now arrived at as great a depth as any lady had yet attempted, I had no inclination to stop short so soon in my undertaking, as the miners beneath us were employed in blasting the rock in every direction. Being desirous of witnessing this the grandest exhibition which it could afford, the miner once more led the way to the ladders, and we commenced our third descent: the only variation being produced by an intense feeling of heat, increasing as we got lower, and a suffocating smell of sulphur—the natural effects of the work which was going on, 200 explosions having taken place since sunrise. When we arrived at the bottom, the sensation was all but suffocating; the dense vapours seemed to fold themselves about our wet garments, and in a few seconds we were enveloped in steam, which produced intense perspiration, and a faint sickness that compelled us to disburthen ourselves of all the *wraps* by which we had sought protection against the damp above. * * * We spent upwards of an hour in strolling through this section of the mine, and during this hour we only encountered three miners, although nearly 300 were at the moment employed in that particular hemisphere—a fact which will give you a better idea of this subterranean wilderness, than any attempt to describe its extent. There was something almost infernal in the picture which presented itself, when we at length returned to the spot where the next blast was to take place. A vast chasm of dark rock was terminated by a wooden platform, on which stood the workmen, armed with heavy iron crow-bars, whose every blow against the living stone, gave back a sound like thunder. I ascended the platform, which was raised above six feet from the rock-cumbered floor of the gallery, in order to see the process of stopping the bore, and then I had a full view of the frightful scene presented by the vault. Above me, the rock had been rent to such a height, that the lamps of the guides failed to afford a glimpse of aught save pitchy darkness, losing itself in its own shadows; beside me toiled the group of miners, thin, sallow, scantily clothed, and scarcely human looking. Beneath me stretched away, far beyond my vision, the vapoury gallery, where the dense mists were writhing and curling in suffocating eddies; while immediately under the platform sat or stood each of our party as had been too idle or too prudent to ascend it. At length the bore was completed; we, of course, made our way before the insertion of the inflammable matter, to a large opening, situated behind an abrupt projection, where an exhausted gallery terminated, and where no mass of rock could reach us in its fall. There we remained for full three minutes in silence, listening to the quick panting of the workmen, ere the mighty rock, riven asunder by the agency and cupidity of man, yielded to a power against which, after centuries of existence, it yet lacked the power to contend, and, with gigantic throes, gave up the hidden treasure it had so long concealed. First comes an explosion, as though the whole artillery of an army burst on the ear at once; and the vast subterranean gives back an echo like the thunders of a crumbling world; while amid the din there is the crash of the mighty rocks which are torn asunder, and fall in headlong ruin on every side; each, as it descends, awaking its own echo, and adding to the uproar; then, as they settle in wild ruin, massed in fastastic shapes, and seeming almost to bar the passage which they fill, the wild shrill cry of the miners rises above them, and you learn that the work of destruction is accomplished.—*From Miss Pardoe's "City of the Magyar."*

ARCHIMEDES.

ARCHIMEDES was born at Syracuse, about B. C. 287. He was one of the first of the Greeks who cultivated the science of mechanics as referring to the action of forces in equilibrio, and producing, not motion, but rest—the doctrine of statics, as it has been called in modern times, as contra-distinguished from dynamics, which treats of bodies in motion. But it is not my intention in this brief notice, to treat

of his researches into this branch of science; I would rather allude to those mirrors with which he is said to have burned the Roman fleet, on its approach within bow-shot of his native city. This curious story is first mentioned by John Tzetzes and Zonaras, writers of the twelfth century, who cite Diodorus and others for the fact. But Galen, in the second century, though he mentions that Archimedes set the enemy's ships on fire, says it was done by πύρια (pyria), which may refer to any machine or contrivance throwing lighted materials.

This interpretation will, I am of opinion, satisfactorily solve what otherwise appears an improbable story. The possibility of making such powerful specula, especially by a combination of small plane mirrors, forming a surface of many faces, approaching to a curved concave form, has been shown by Buffon; but that this advanced knowledge, which was the result of unwearied diligence on the part of the French philosopher, was attained by Archimedes, is to me incredible, considering the low state of science at the time in which he lived.

W. G. Hall.

[Πύρια is a vague term which, as our correspondent intimates, may be applied to a tin saucepan, a steam-boiler, or a cannon. A speculum, or any other optical instrument of sufficient magnitude to produce the effect described at so great a distance, must be an erection difficult to move, and to suppose that the ships would come one after the other, and place themselves exactly in the focus, is too absurd even for the ancients to believe; but whatever they may say or believe, we are not compelled to forsake our reason and believe lies, because they told them 2000 years ago.—Ed.]

LIST OF NEW PATENTS.

John Duncan, of Great George Street, Westminster, gentleman, for improvements in machinery for cutting, reaping, or severing grass, grain, corn or other like growing herbs. Communicated by a foreigner residing abroad. Sealed November 2, 1840. (Six months.)

Elijah Galloway, of Manchester Street, engineer, for improvements in propelling rail-road carriages. Sealed November 2, 1840. (Six months.)

Josiah Pumphrey, of New Tower Row, Birmingham, brass-founder, for certain improvements in machinery to be employed in the manufacture of wire hooks and eyes. Sealed November 2, 1840. (Six months.)

Henry Wimshurst, of Limehouse, ship-builder, for improvements in steam vessels, in communicating power to propellers of steam-vessels, and in shipping and unshipping propellers. Sealed November 2, 1840. (Six months.)

James Heywood Whitehead, of Royal George Mills, York, manufacturer, for improvements in the manufacture of woollen belts, bands or driving-straps. Sealed November 2, 1840. (Six months.)

James Boydell, junior, of Cheltenham, for improvements in working railway and other carriages, in order to stop them, and also to prevent their running off the rails. Sealed November 2, 1840. (Six months.)

John Edward Orange, of Lincoln's Inn, Old Square, captain in the 81st Regiment, for improvements in apparatus for serving ropes and cables with yarn. Sealed November 2, 1840. (Six months.)

Herman Schroeder, of Surrey Cottage, Peckham, broker, for improvements in filters. Communicated by a foreigner residing abroad. Sealed November 2, 1840. (Six months.)

John Wordsworth Robson, of Wellclose Square, artist, for certain improvements in water closets. Sealed November 2, 1840. (Six months.)

Richard Farger Emmerson, of Walworth, gentleman, for improvements in applying a coating to the surfaces of iron pipes and tubes. Sealed November 3, 1840. (Six months.)

John Rapson, of Limehouse, millwright, for improvements in paddle-wheels for propelling vessels by steam or other power. Sealed November 3, 1840. (Six months.)

Henry Hind Edwards, of Nottingham Terrace, New Road, engineer, for improvements in evaporation. Sealed November 5, 1840. (Six months.)

Pierre Mathew Mannory, of Leicester Square, gentleman, for improvements in wind and stringed musical instruments. Communicated by a foreigner residing abroad. Sealed November 5, 1840. (Six months.)

George Gwynne, of Duke Street, Manchester Square, gentleman, for improvements in the manufacture of candles, and in operating on oils and fats. Sealed November 5, 1840. (Six months.)

George Dacres Paterson, of Truro, Esquire, for improvements in curvilinear turning—that is to say, a rest adapted for cutting out wooden bowls, and a self-acting side rest for other kinds of curvilinear turnings. Sealed November 5, 1840. Six months.)

Henry Kirk, of Blackheath, gentleman, for improvements in the application of a substance or composition as a substitute for ice for skating and sliding purposes. Sealed November 6, 1840. (Six months)

Charles Joseph Hullmandel, Great Marlborough Street, lithographic printer, for a new effect of light and shadow, imitating a brush or stump drawing, or both combined, produced on paper; being an impression from a plate or stone prepared for that purpose, as also the mode of preparing the said plate or stone for that object. Sealed November 5, 1840. (Four months.)

John Clarke, of Islington, Lancaster, plumber and glazier, for a hydraulic double-action force

and lift-pump. Communicated by a foreigner residing abroad. Sealed November 5, 1840. (Six months,)

George Delianson Clark, of the Strand, gentleman, for an improvement in purifying tallow, fats and oils for various uses, by purifying them and depriving them of offensive smells, and solidifying such as are fluid, and giving additional hardness and solidity to such as are solid, and also by a new process of separating stearine or stearic-acid from the elanie in such substances. Communicated by a foreigner residing abroad. Sealed November 5, 1840. (Six months.)

Alexander Horatio Simpson, of New Palace Yard, Westminster, gentleman, for a machine or apparatus to be used as a moveable observatory or telegraph, and as a moveable platform in erecting, repairing, painting, or cleaning the interior and exterior of buildings, and also as a fire-escape. Communicated by a foreigner residing abroad. Sealed November 5, 1840. (Six months.)

Andrew Kurtz, of Liverpool, manufacturing chemist, for a certain improvement or certain improvements in the construction of furnaces. Sealed November 5, 1840. (Six months.)

George Halpin, jun., of Dublin, civil engineer, for improvements in applying air to lamps. Sealed November 7, 1840. (Six months.)

William Crofts, of New Radford, Nottingham, machine-maker, for certain improvements in machinery, for the purpose of making figured or ornamental bobbin-net or twist-lace, and other ornamental fabrics, looped or woven. Sealed November 7, 1840. (Six months.)

Charles De Bergue, of Blackheath, gentleman, for improvements in machinery for making reeds used in weaving. Communicated by a foreigner residing abroad. Sealed November 7, 1840. (Six months.)

Thomas Lawes, of Canal Bridge, Old Kent Road, feather-factor, for certain improvements in the me hod or process, and apparatus for cleansing or dressing feathers. Sealed November 13, 1840. (Six months.)

William M'Kinley, of Manchester, engraver, for certain improvements in machinery or apparatus for measuring, folding, ploiting, or lapping goods or fabrics. Sealed November 10, 1840. (Six months.)

Charles Edwards Amos, of Great Guilford Street, millwright, for certain improvements in the manufacture of paper. Sealed November 10, 1840. (Six months.)

Thomas William Parkin and Elisha Wilde, of Portland Street, Liverpool, engineers, for an improved method of making and working locomotive and other steam engines. Sealed November 12, 1840. (Two months.)

Eugenius Birch, of Cannon Row, Westminster, civil engineer, for improvements applicable to railroads, and to the engines and carriages to be worked thereon. Sealed November 12, 1840. (Six months.)

John Heaton, of Preston, overlooker, for improvements in dressing yarns of linen or cotton, or both, to be woven into various sorts of cloth. Sealed November 12, 1840. (Six months.)

MISCELLANEA.

Electricity of Steam.—The observation lately made by a workman at Seg Hill, near Newcastle-upon-Tyne, and described in the "Mechanic," of the electrical state of steam issuing from an opening on the top of a high-pressure steam-engine boiler, is not new. The fact has long been known to electricians; and a gentleman resident near this city, years ago, made some curious experiments on the electricity of vapours issuing freely into the atmosphere when liberated from the safety-valve of steam-engine boilers; and he considers the fact lately observed near Newcastle, to be a farther confirmation of his opinion, that the electricity of clouds is principally caused by evaporation from every moist surface—whether from that of water, leaves of vegetables, or moist soil, under the influence of the sun and wind.—*Hereford Journal.*

Anti-Railway Wit.—It is proposed to form, in connexion with some of the present railway companies, cemeteries on the new principle of making use of the spare land on the sides of the railways, and on the slopes of the cuttings and embankments, for the purpose of interring those who may from time to time be destroyed on the lines, whether passengers or servants of the companies. It is also proposed that the profits accruing from this source (which it is confidently expected will be considerable) should be applied to the establishment of hospitals at the respective termini, and at some of the principal stations, for the relief of those in whom life may not be at once extinct.—*Times.*

[In the course of investigating the circumstances of the late lamentable accident on the London and Birmingham Railway, it was shown that since the opening of that line, there had been travelled 89,885,000 miles by 1,349,000 passengers, not one of whom had died by accident, while of the Company's servants, but five or six in all had been killed. A surprisingly small amount, considering that the distance travelled is nearly as far as the sun from the earth. —Ed. Mec. & Chem.]

Predictions Fulfilled.—The admirers of cabalistic prognostications will be amused by the following calculations. If the year 1774 (death of Louis XV.) be taken, and its digits be successively added to the figure in the unit's place of that number, the year 1793 will be obtained (death of Louis XVI.) Thus $1774 + 1 + 7 + 7 + 4 = 1793$. If 1794 (death of Robespierre) be taken, and the same operation repeated, it will give 1815 (final fall of Napoleon); the same process applied to that year gives 1830 (fall of Charles X); and the same operation applied to 1830, gives 1842, of which the astrologer bids us *beware!* In the "Memoir of Josiah Quincy, of Massachusets," a name familiar to the history of the American revolution, we find in his journal the following remarkable entry:—"December 14th (1774). Spent the evening with Mr. Sayre, in company with Doctor Franklin and others. In the course of conversation, Doctor Franklin said, that more than sixteen years ago, long before any dispute with America, the present Lord Camden, then Mr. Pratt, said to him, "For all what you Americans say of your loy-

alty and all that, I know you will, one day, throw off your dependence on this country; and, notwithstanding your boasted affection for it, you will set up for independence." If to the date of the prediction (1758) be added the sum of its digits (21) we shall have 1779; at which period the independence of the United States was virtually established, though not recognised by England till 1783.

Meteorology.—Effect of Wind upon the Atmosphere.—The following laws have been deduced from extended experiments by Kamtz and Dove. 1. The barometer falls under the influence of the east, south-east and south winds; the descent changes to ascent by the south-west wind; rises by the west, north-west and north winds; the ascent changes to descent by the north-east wind. This law is deduced from observations, made at Paris four times a-day, at first for five years, then for ten years, 1816—25. 2. The thermometer rises by the east, south-east and south winds; the ascent changes to descent by the south-west wind; falls by the west, north-west and north; the descent changes to ascent by the north-east wind. This and the following are believed to be based upon observations made at Paris and London, and have been confirmed by observations of Kamtz himself during four years. 3. The elasticity of aqueous vapour is increased by the east, south-east and south winds; its increase changes to decrease by the south-west wind; it decreases by the west, north-east and north winds, and its decrease changes to increase by the north-east wind. 4. The humidity of the atmosphere decreases relatively from the west wind, passing by the north to the east, and increases, on the contrary, from the east by the south to the west.

Overflowing of the Rhone.—The causes of the late inundation are thus explained in the French journals. The meteorological observations made in the city of Lyons give, as the measure of the rain which fell there during the 27th of October, and six following days, 32 centimetres, and 4 millimetres, or rather more than 12 1-8th English inches. The yearly average at Lyons being 54 centimetres, or 21 1-10th inches. To this phenomenon was added a burning southern and south-west wind, which prevailed during three weeks in the upper Alps, melting immense masses of snow, which sent down their fatal tribute.

As the workmen were digging a new paint-pit at Llanlinna, near Amlwych, they discovered within three feet of the surface a stone urn, on opening which they found a human skeleton in a high state of preservation, measuring the extraordinary length of seven feet six inches. The skeleton throughout was quite proportional to its length, and in very perfect condition. The urn appears to have been made from the Aberdovey limestone, and had the appearance of being much corroded by time. From the rude nature of this urn or coffin, it seems probable that the body had been first laid in the grave, and limestone placed round its sides and on the top only, which, from the length of time they had laid under ground, had become cemented together.—*Welch Paper.*

A Long Yarn.—The longest rope on record, in one unspliced piece, has just been finished in Sunderland. It is upwards of 400 yards long, seven inches in circumference, and twelve tons weight, and will cost about 400*l*. It is for the use of the London and Birmingham Railway.—*Leeds Intelligencer.*

Paris Railroad.—The original Paris station of the St. Germain, St. Cloud, and Versailles Railroad, which is now removed to the Rue St. Lazare, was in use three years and three months. During this period the number of passengers by the St. Germain line amounted to 4,114,260, and by the Versailles line, which was open only 14 months, to 1,643,694. Thus the total number of passengers by both lines was 5,757,000, being more than five times the whole population of Paris.

INSTITUTIONS.

LECTURES DURING THE WEEK.

Westminster Literary and Scientific Institution, 6 and 7, Great Smith Street.—Wednesday, December 30, R. Addams, Esq., on Acoustics. At half-past eight.

Pestalozzian Academy, Worship Square.—Tuesday, December 29, Mr. F. Wilby, on Vital Education.

Bermondsey and Rotherhithe Literary and Scientific Institution, 4½, Church Street, Rotherhithe.—Monday, Dec. 28, General Quarterly Meeting. At half-past eight precisely.

ADDRESS TO THE READERS OF THE MECHANIC AND CHEMIST.

ANNOUNCEMENT OF A THIRD SERIES.

CONSIDERING that it will be more convenient for our volumes to end with the year, we have determined on closing this volume with our last number, in December. We shall therefore commence our THIRD SERIES, with the first number in the new year, and in future, each volume will contain the whole of the numbers as issued in the particular year to which they belong, which, from the circumstances under which the work was commenced, has not hitherto been the case.

We are determined that the support our work has received, shall be met on our part by increased attention, and we solicit from our readers such communications as they consider calculated to interest their fellow-mechanics.

We would suggest to the operatives in our numerous manufactories, that much might be done, not only to improve the various machines, and the articles on which they are employed in producing, but in many cases to render their occupations more convenient to them-

selves, if they would send forth—as they may easily do through this work—such ideas as suggest themselves during their various operations. How frequently do they hear from each other, "What an improvement this or that alteration would be!" "How much more conveniently should we work, if such a change were effected in this or that machine!" And whatever the operatives may think, masters would gladly adopt these improvements, if reasonably and properly suggested. We feel convinced, that could the ideas of practical persons be collected, improvements would be made long before they are. When what is called a new invention comes out, how simple it appears, how wonderful that it was not before thought of. But what is the fact? Most of these things have often been thought of by others, but have not been put into shape and brought forward. Now we offer to such persons the means of rendering their thoughts useful to themselves and others; and we promise them, that their communications shall be promptly attended to, reserving, of course, to ourselves the right of selection.

Other mechanics' magazines have been published since the commencement of this work, but none of them have ventured to undertake the risk, expense, and labour, at the low rate of a penny each number; to distinguish therefore our work from others, we resume in this series the designation of the

PENNY MECHANIC AND CHEMIST.

Considering the expense of the numerous and complicated cuts contained in this work, it should be remembered that it is only by extensive circulation that it can be maintained; we would therefore suggest to those of our readers who think the work worth their attention, that they should recommend it to their friends and acquaintance. We cannot but think that to an operative it must be interesting to know what is going on in the mechanical world, and by the expenditure of ONE PENNY on a SATURDAY night, he may have an idea suggested to him that may lead to his advancement in the art which he follows.

We also wish to inform our correspondents, that we are anxious not only to receive communications strictly mechanical and chemical, but we also wish to obtain information of a generally interesting kind, connected with the arts and the artist. This is perhaps an extensive scope, for very little indeed is there in our present state of existence not connected with and dependent on them.

TO CORRESPONDENTS.

W. Simmons.—*Trewhitt's patent (enrolled June 4, 1840) does not relate to any improvement in the composition of earthenware; it consists in the substituting machinery for manual labour, by employing moulds or dies, and pressure, instead of the usual process of turning.*

A. A. (Liverpool), *and several other correspondents, propose plans for instantaneously detaching the engine from the train; but they have not informed what advantage they expect to derive from so doing.*

W. J. Cuthbert.—*We should be glad to see his papers on cheap philosophical instruments.—There is much truth in his "Hints to Querists;" it is unreasonable to expect that we should entertain the public with invidious recommendations of particular tradesmen; or that we should "go round to old iron shops to find out the cheapest place for buying old metal tubing" &c.—A reference to the past numbers of the "Mechanic," will show how many inquiries involving philosophical principles of general interest, have been fully and accurately answered by the Editor, or by our correspondents; but we cannot insert paragraphs which, under the guise of queries, are, in reality, advertisements, for which we should be liable to pay the duty; neither do we think it right to insert or answer questions upon subjects which are totally foreign to the intention of this work, or of so frivolous a nature, that they might be answered in any shop that deals in the articles referred to. But notwithstanding these little restrictions, we by no means wish to discourage legitimate querists. Past experience has proved how much useful information is derived from this source, and we shall continue to give our readers the best information in our power, or appeal to our correspondents for such specialities as we may be unacquainted with.*

J. C. B. *may obtain the essential oils from herbs, by distillation in a common retort, only taking care to keep the tube cool, otherwise the oil will escape in vapour. The operation of distillation cannot be performed without heat.*

A. S. M.—*The steam-guage was described in a former number of the "Mechanic"—it is constructed on the principle of the barometer, but with a certain portion of air above the mercury, to avoid the inconvenience of the great height of column which would be required to indicate the great pressure it has to sustain.*

ERRATUM.—Page 237, col. 1, line 23, for "pressure" read *pressers*.

London: Printed at "THE CITY PRESS," 1, Long Lane, Aldersgate, by DOUDNEY & SCRYMGOUR (to whom all communications for the Editor must be addressed, postage paid); published every Saturday, by G. BERGER, Holywell Street, Strand; and may be had of all Booksellers and Newsmen in Town and Country.

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END OF VOL. VI.

City Press, 1, Long Lane: Doudney and Scrymgour.